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introduction to
PSYCHOLOGY
12E

James W. Kalat

Introduction to

Psychology 12e

James W. Kalat

North Carolina State University

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To my wife, Jo Kalat

JAMES W. KALAT (rhymes with ballot) is Professor Emeritus at North Carolina State University, where he taught Introduction to Psychology and Biological Psychology for 35 years. Born in 1946, he received an AB degree summa cum laude from Duke University in 1968 and a PhD in psychology in 1971 from the University of Pennsylvania, under the supervision of Paul Rozin. He is also the author of *Biological Psychology*, 13th edition (Cengage, 2019), and coauthor with Michelle N. Shiota of *Emotion*, 3rd edition (Oxford University Press, 2018). In addition to textbooks, he has written journal articles on taste-aversion learning, the teaching of psychology, and other topics. A remarried widower, he has three children, two stepsons, and five grandchildren. When not working on something related to psychology, his hobby is bird-watching.

brief contents

contents

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iStock.com/Jelena83

Christoph Hetzmannseder/Moment/Getty Images

Liderina/Shutterstock.com

Koji Aoki/Getty Images

7 Memory 209

iStock.com/Rich Legg

8 Cognition and Language 243

Nolte Lourens/Shutterstock.com

sturti/E+/Getty Images

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Chinnapong/Shutterstock.com

mlorenzphotography/Moment/Getty Images

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WAYHOME studio/Shutterstock.com

15 Abnormal Psychology:
Disorders and Treatment 477

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Some years ago, I was on a plane that had to turn around shortly after takeoff because one of its two engines had failed. When we were told to get into crash position, the first thing I thought was, "I don't want to die yet! I was looking forward to writing the next edition of my textbook!" True story.

I remember taking my first course in psychology. Frequently, I would describe something I had just learned to my roommate, friends, or relatives. I haven't changed much since then. When I read about interesting new research, I want to tell someone. Psychology is fun. During my 35 years of teaching at North Carolina State University, I would often wake up in the morning and think, "Wow! I get to teach about optical illusions today!" or "Great! Today's topic is emotions!" Do professors in other fields enjoy teaching so much? Does someone in the French department wake up thinking how exciting it will be to teach about adverbs today? I doubt it.

Ideally, a course or textbook in psychology should accomplish two goals. The first is to instill a love of learning so that our graduates will continue to update their education. Even if students permanently remembered everything they learned—and of course they won't—their understanding would gradually go out of date unless they continue to learn about new developments. The second goal is to teach students the skills of evaluating evidence and questioning assertions, so that when they do read about some new research, they will ask the right questions before drawing a conclusion. That skill can carry over to fields other than psychology.

Throughout this text, I have tried to model the habit of critical thinking or evaluating the evidence, particularly in the **What's the Evidence?** features that describe research studies in some detail. I have pointed out the limitations of the evidence and the possibilities for alternative interpretations. The goal is to help students ask their own questions, distinguish between good and weak evidence, and ultimately, appreciate the excitement of psychological inquiry.

Approaches, Features, and Student Aids

Many years ago, I read an educational psychology textbook that said children with learning disabilities and attention problems learn best from specific, concrete examples. I remember thinking, "Wait a minute. I do, too! Don't we *all* learn best from specific, concrete examples?" For this reason, science classes use laboratories to let students see for themselves. Few introductory psychology classes offer laboratories, but we can nevertheless encourage students to try procedures that require little or no equipment. At various points, the text describes **Try It Yourself** exercises, such as negative afterimages, binocular rivalry, encoding specificity, and the Stroop effect. Students who try these activities will understand and remember the concepts far better than if they merely read about them.

Cognitive psychology researchers find that we learn more if we alternate between reading and testing than if we spend the same amount of time reading. The **Concept Checks** pose questions that attentive readers should be able to answer. Students who answer correctly can feel encouraged. Those who miss a question should use the feedback to reread the relevant passages.

Each chapter of this text has two to five modules, each with its own summary, key terms, and review questions. Modules provide flexibility for instructors who wish to take sections in a different order, or who wish to omit a section. Modular format also breaks up the reading assignments so that students read one or two modules for each class. At the end of the text, a combined Subject Index and Glossary define key terms and provide page references.

The technology of education changed only a little from the invention of chalk until the late twentieth century. Today, however, wonderful new technologies are available. MindTap for *Introduction to Psychology* includes an eBook, special Concept Checks for each section, Chapter Quizzes, and more!

What's New in the Twelfth Edition

The most prominent development in psychology over the last decade has been the increased interest in replication and careful research design. The eleventh edition already discussed the replication issue, and this edition increases the emphasis. Also, several studies that the previous edition discussed had to be eliminated because they appear to be non-replicable, and a couple others are mentioned, but described as uncertain because of inconsistent

replications. This edition also introduces the methodological problems of HARKing (hypothesizing after results are known) and *p*-hacking (re-analyzing results until one finds a way for *p* to appear significant).

One notable change in the overall organization is that discussion of behaviorism is now in Chapter 6 (learning) instead of Chapter 1 (introduction). Another is the introduction of a new section about conspiracy thinking, in Chapter 8. Chapter 9 has a new section about the relationship between brain size and intelligence. When we compare species, an issue has been why humans are (in our opinion, anyway) the most intelligent, although other species have a larger brain or a larger brain-to-body ratio. We now have an answer: Humans have the largest number of neurons. Chapter 11 raises the difficult, unanswered question about how to rear children who think they might be transgender. Chapter 12 has a new section about ways to facilitate forgetting of a traumatic experience. Chapter 13 introduces "nudges" as a means of persuasion. One more major change: The reference list at the end of the book conforms to the new APA style, including web sites where available, and (by APA's insistence) up to 20 authors per article. Yeah, all those students who care about the names of the 19th and 20th authors of an article will be so pleased.

The content of this text has been brought up to date in many ways. Here are a few of my favorite new studies:

- It was previously shown that acetaminophen can reduce hurt feelings. A new study found that it also reduces pleasure. Evidently it reduces overall emotional responsiveness. (Chapter 4)
- Yes, water does have a taste, not just a texture on the tongue. Water changes the response pattern of sourness receptors. (Chapter 4)
- Adolescents take greater risks in the presence of their peers, and fewer risks if their mothers are watching. (Chapter 5)
- An eyewitness's degree of confidence about an identification correlates with accuracy at the time of initial response, although confidence at the time of a trial does not (because of contamination by feedback from police and others). (Chapter 7)
- When you describe what you remember of some event, you strengthen your memory of the aspects that you describe, but you weaken your memory of aspects you did not mention. This tendency is called retrieval-induced forgetting. (Chapter 7)
- When people regard themselves as highly competent on a topic, they tend to exaggerate that competence. For example, many people who call themselves well informed about

personal finance will rate themselves highly on understanding "pre-rated stocks" and "fixed rate deduction," which are meaningless terms that an experimenter threw in to test them. (Chapter 8)
- Stereotype threat affects old people in a special way. Old people are not worried about defending their group from the stereotype of poor memory. (They generally agree that the stereotype is true.) They are simply worried that they themselves might fit the stereotype. (Chapter 9)
- The famous story about "38 silent witnesses" to the Kitty Genovese story was apparently planted by police to distract attention from their dubious prosecution of an innocent defendant in another case. (Chapter 13)
- Sherif's famous "Robbers Cave" study failed to report several ways in which the "counselors" (experimenters) rigged the procedures to encourage hostility between the two groups. (Chapter 13)
- Ordinarily, romantic couples resemble each other in physical attractiveness, but an exception arises for couples who were friends for years before they started dating. (Chapter 13)
- Most American college students accept the "belief in a just world" for themselves more than for people in general. (Chapter 14)
- Nearly half a century ago, parents reported that children with autism acted more normally when they had a fever. Now, finally, we have an explanation for why this is so. (Chapter 15)

In addition to the throughly updated text, the Test Bank has been revised. Written by the author himself, the test bank for *Introduction to Psychology* consists of more than 3,700 new or reworded items, with an emphasis on clarity. Nearly all items are worded in the form of a question, and none of them include an "all of the above" or "none of the above" choice. The test bank also includes a special file of items that cut across chapters intended for inclusion on a comprehensive final exam. See the Instructor Resources section for more details.

MindTap

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MindTap is a platform that propels students from memorization to mastery. It gives you complete control of your course, so you can provide engaging content, challenge every learner, and build student confidence. Customize interactive syllabi to emphasize priority topics, then add your own material or notes to the eBook as desired. This outcomes-driven application gives you the tools needed to empower students and boost both understanding and performance.

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Instructor Resources

Additional instructor resources for this product are available online. Instructor assets include an Instructor's Manual, Educator's Guide, PowerPoint® slides, and a test bank powered by Cognero®. Sign up or sign in at **www.cengage.com** to search for and access this product and its online resources.

Acknowledgments

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Many reviewers provided helpful and insightful comments. Each edition builds on contributions from reviewers of previous editions. I would like to thank the following reviewers who contributed their insight to one or more editions:

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James W. Kalat

Welcome to introductory psychology! I hope you will enjoy reading this text as much as I enjoyed writing it. I have tried to make this book interesting and easy to study.

Features of This Text

Modular Format

Each chapter is divided into two or more modules so that you can study a limited section at a time. Each chapter begins with a table of contents and a list of learning objectives. At the end of each module is a summary of important points, a list of key terms, and a few multiple-choice questions. Although the multiple-choice questions are listed at the end, you may find it a good strategy to try answering them before you read the module. Trying the questions at the start will prime you to pay attention to those topics. Do not assume that the summary points and the review questions include everything you should learn! They are only a sampling.

Key Terms

When an important term first appears in the text, it is highlighted in **boldface** and defined in *italics*. All the boldface terms are listed alphabetically at the end of each module. They appear again with definitions in the combined Subject Index and Glossary at the end of the book. You might want to find the Subject Index and Glossary right now and familiarize yourself with it.

I sometimes meet students who think they have mastered the course because they have memorized the definitions. The title of the course is "psychology," not "vocabulary." You do need to understand the defined words, but don't memorize the definitions word for word. It would be better to try to think of examples of each term. Better yet, when appropriate, think about the evidence relating to the concept.

Questions to Check Your Understanding

People remember material better if they alternate between reading and testing than if they spend the whole time reading. We consider that point again in the chapter on memory. At various points in this text are Concept Checks, questions that ask you to use or apply the information you just read. Try to answer each of them before reading the answer. If your answer is correct, you can feel encouraged. If it is incorrect, you should reread the section.

Try It Yourself Activities

The text includes many items marked "Try It Yourself." Most of these can be done quickly with little or no equipment. The description of a psychological principle will be easier to understand and remember after you have experienced it yourself.

"What's the Evidence?" Features

With the exception of the introductory chapter, every chapter includes a section titled "What's the Evidence?" These features highlight research studies in more detail, specifying the hypothesis (idea being tested), research methods, results, and interpretation. In some cases, the discussion also mentions the limitations of the study. These sections provide examples of how to evaluate evidence.

Indexes and Reference List

A section at the back of the book lists the references cited in the text in case you want to check something for more details. The references include websites where available. The combined Subject Index and Glossary defines key terms and indicates where in the book to find more information. The name index provides the same information for all names mentioned in the text.

Answers to Some Frequently Asked Questions

Do you have any useful suggestions for improving study habits? Whenever students ask me why they did badly on the last test, I ask, "When did you read the assignments?" A common answer is that they read everything the night before the test. If you want to learn the subject matter well, read the assigned material before the lecture, review it after the lecture, and quickly go over it again a few days later. Then reread the textbook assignments and your lecture notes before a test. Memory researchers have established that you will understand and remember something better by studying it several times spread out over days than by studying the same amount of time all at once. Also, of course, the more times you review the material, the better.

When you study, don't just read the text but stop and think about it. The more actively you use

the material, the better you will remember it. One way to improve your studying is to read by the SPAR method: **S**urvey, **P**rocess meaningfully, **A**sk questions, **R**eview.

Survey: Know what to expect so that you can focus on the main points. When you start a module, first look over the learning objectives. It also helps if you turn to the end and read the summary and try to answer the review questions.

Process meaningfully: Read the chapter carefully, stopping to think from time to time. Tell someone about something you learned. Think about how you might apply a concept to a real-life situation. Pause when you come to the Concept Checks and try to answer them. Do the Try It Yourself exercises. Try to monitor how well you understand the text and adjust your reading accordingly. Good readers pause frequently to think about what they have read.

Ask questions: When you finish the chapter, try to anticipate what questions your instructor would ask on a test. What questions would you ask if you were the professor? Write out the questions, think about them, and hold them for later.

Review: Pause for at least an hour, and then return to your questions and try to answer them. Check your answers against the text. Reinforcing your memory after you first read the chapter will help you retain the material longer and deepen your understanding. If you study the same material several times at lengthy intervals, you increase your chance of remembering it long after the course is over.

What do those parentheses mean, as in "(Shallice, 2019)"? Am I supposed to remember the names and dates? Psychologists generally cite references in the text in parentheses rather than in footnotes. "(Shallice, 2019)" refers to an article written by Shallice, published in 2019. All the references cited in the text are listed in alphabetical order by the author's last name in the References section at the back of the book. You will also notice a few citations that include two dates separated by a slash, such as "(Wundt, 1862/1961)." This means that Wundt's document was originally published in 1862 and was republished in 1961. No, you should not memorize the parenthetical source citations. They are provided so interested readers can look up the source of a statement and check for further information. The few names that *are* worth remembering, such as B. F. Skinner, Jean Piaget, and Sigmund Freud, are emphasized in the discussion itself.

Can you help me read and understand graphs? You will encounter four kinds of graphs in this text:

pie graphs, bar graphs, line graphs, and scatter plots. Let's look at each kind.

A pie graph shows the components of a whole. Figure 1 shows the proportion of psychologists who work in various settings.
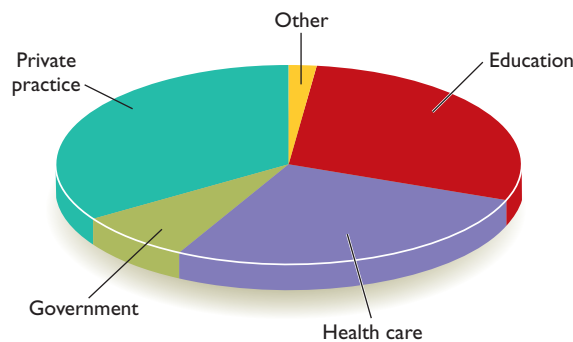
Figure 1

Bar graphs show measurements for two or more groups. Figure 2 shows how much unpleasantness three groups of women reported while they were waiting for a painful shock. The unpleasantness was least if a woman could hold her husband's hand while waiting, intermediate if she held a stranger's hand, and most if she was by herself.
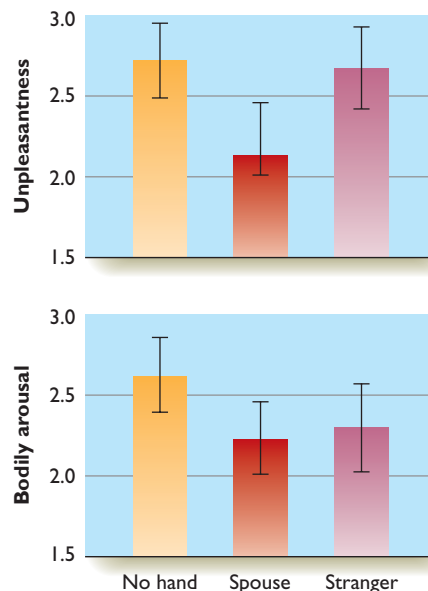
Figure 2

Line graphs show how one variable relates to another variable. Figure 3 shows measurements of conscientiousness in people from age 10 to 80. The upward slope of the line indicates that older people tend to be more conscientious than younger people, on average.

Conscientiousness
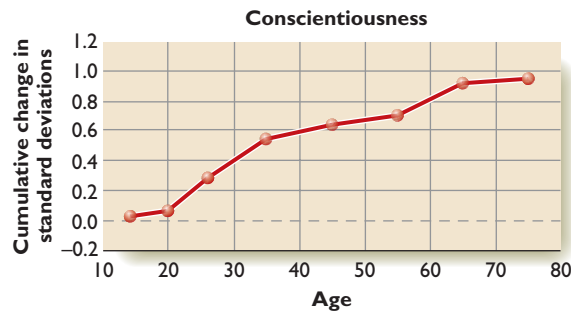
Figure 3

Scatter plots are similar to line graphs, with this difference: A line graph shows averages, whereas a scatter plot shows individual data points. By looking at a scatter plot, we can see how much variation occurs among individuals.
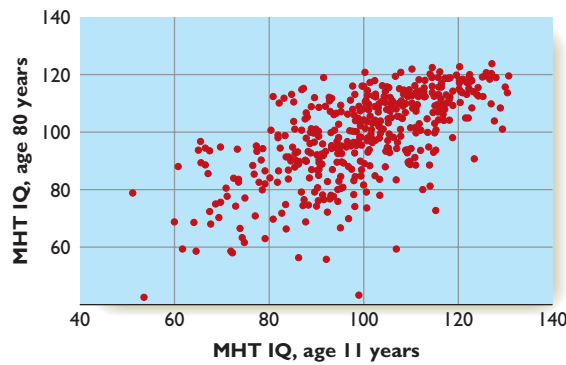
Figure 4

To prepare a scatter plot, we make two observations about each individual. In Figure 4, each person is represented by one point. If you take that point and scan down to the *x*-axis, you find that person's score on an IQ test at age 11. If you then scan across to the *y*-axis, you find that person's score on a similar test at age 80. You can see how consistent people's scores are over a lifetime.

We may have to take multiple-choice tests on this material. How can I do better on those tests?

1. Read each choice carefully. Do not choose the first answer that looks correct because a later answer might be better.
2. If you don't know the correct answer, make an educated guess. An answer that includes absolute words such as "always" or "never" is probably wrong. If you have never heard of something, it is probably not the right answer. Remember, every test question is about something presented either in lecture or in the text.
3. After you finish, don't be afraid to go back and reconsider your answers. Students have been telling each other for decades that "you should stick with your first answer," but research says that most people who change their answers improve their scores. When you examine a question a second time, you sometimes discover that you misunderstood it the first time.

Last Words Before We Start . . .

Most of all, I hope you enjoy the text. I have tried to include the liveliest examples I can find. The goal is not just to teach you some facts but also to teach you a love of learning so that you will continue to read more and educate yourself about psychology long after your course is over.

James W. Kalat

1 What Is Psychology?

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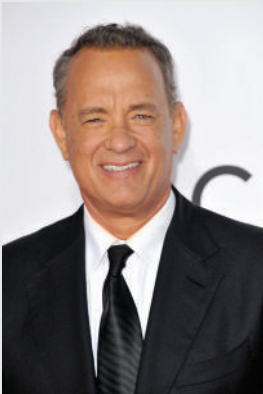
Even when the people we trust seem very confident of their opinions, we should examine their evidence or reasoning.

If you are like most students, you start off assuming that nearly every-thing you read in your textbooks and everything your professors tell you must be true. What if it isn't? Suppose impostors have replaced your college's faculty. They pretend to know what they are talking about and they all vouch for one another's competence, but in fact, they are all unqualified. They managed to find textbooks that support their prejudices, but those textbooks are full of false information, too. If so, how would you know?

While we are entertaining such skeptical thoughts, why limit ourselves to colleges? When you read books and magazines or listen to political commen-tators, how do you know who has the right answers?

No one has the right answers all of the time. One professor starts his first day of class by saying, "At least 10 percent of what I tell you will be wrong. But I don't know which 10 percent it is." Sometimes even the best and most conscientious individuals discover to their embar-rassment that a confident opinion was wrong. I don't mean to imply that you should disregard everything you read or hear. But you should expect people to tell you the reasons for their conclusions, so that you can decide which ones to follow with confidence and which ones are just a guess.

You have just encountered the theme of this book: Evaluate the evidence. You will hear all sorts of claims concerning psychology, as well as medicine, politics, religion, and other fields. Some are valid, some are wrong, some are hard to evaluate for sure, many are valid under certain conditions, and some are too vague to be either right or wrong. When you finish this book, you will be in a better position to examine evidence and decide which claims to take seriously.

module 1.1

Psychologists' Goals

After studying this module, you should be able to:

1. Discuss three major philosophical issues important to psychology.

2. Distinguish psychology from psychiatry and psychoanalysis.

3. Give examples of specializations in psychology, for both research and practice.

Your history text probably doesn't spend much time discussing what the term *history* means, nor does a course on English literature spend the first day defining literature. Psychology is different, because so many people have misconceptions about it. A student once asked me when we would get to the kind of psychology he could "use on" people. Another young man asked me (in my office, not publicly) whether I could teach him tricks to seduce his girlfriend. I told him that (1) psychologists don't try to trick people into doing something against their better judgment, (2) if I did know tricks like that, ethically I couldn't tell him about them, and (3) if I knew powerful tricks to control behavior *and* I had no ethics, I would probably use those powers for profit instead of teaching introduction to psychology!

The term *psychology* derives from the Greek roots *psyche,* meaning "mind" or "soul," and *logos,* meaning "word." Psychology is literally the study of the mind or soul, and people defined it that way until the early 1900s. Around 1920, psychologists became disenchanted with the idea of studying the mind. First, research deals with what we observe, and mind is unobservable. Second, talking about "the mind" implies it is a thing or object. Mental activity is a process. It is not like the river but like the flow of the river, not like the automobile but like the movement of the automobile. Beginning in the early 1900s, psychologists defined their field as the study of behavior.

Behavior is important, but is behavior the only thing we care about? When you look at this optical illusion and say that the horizontal part of the top line looks longer than that of the bottom line (although really they are the same length), we wonder why the line *looks* longer, not why you *said* it looks longer. So let's define **psychology** as *the systematic study of behavior and experience.* The word *experience* lets us discuss your perceptions without implying that a mind exists independently of your body.
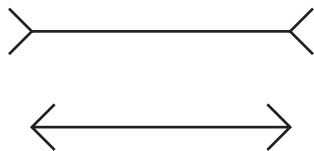
When people think of psychologists, mostly they think of clinical psychologists—those who try to help worried, depressed, or otherwise troubled people. Clinical psychology is part of psychology, but it is only one part. Psychology also includes research on sensation and perception, learning and memory, hunger and thirst, sleep, attention, child development, and more. Perhaps you expect that a course in psychology will teach you to analyze people and decipher hidden aspects of their personality. It will not. You will learn to understand many aspects of behavior, but you will gain no dazzling powers.

Ideally, you will become more skeptical of those who claim to analyze people's personality based on small samples of their behavior.

General Points about Psychology

Let's start with three of the most general statements about psychology. Each of these will arise repeatedly throughout this text.

"It Depends"

Hardly anything is true about the behavior of all people all the time. Almost every aspect of behavior depends on age, genetics, health, past experiences, and whether people are currently awake or asleep. Some aspects of behavior differ between males and females or from one culture to another. Behavior can also vary depending on the time of day, the temperature of the room, or how recently someone ate. How you might answer a question depends on the wording of the question, the wording of the previous question, and who is asking the questions.

If psychology regards "it depends" as a general truth, you may infer that psychology really doesn't know anything. On the contrary, "it depends" is a serious point. The key is to know *what* it depends on. The further you pursue your studies of psychology, the more you will become attuned to the wealth of subtle influences that people easily overlook. Here is an example: Decades ago, two psychology laboratories were conducting similar studies on human learning but reporting contradictory results. Both researchers were highly respected, they were following the same procedures, and they did not understand why their results differed. Eventually, one of them traveled to the other's university to watch the other in action. Almost immediately, he noticed one key difference: the chairs in which the participants sat! His colleague at the other university had obtained chairs from a retired dentist, and therefore his research participants were sitting in *dentist's* chairs, during an era when dental procedures were often painful. The participants were sitting there in a state of heightened anxiety that altered their behavior (Kimble, 1967).

Progress Depends on Good Measurement

Nobel Prize–winning biologist Sydney Brenner was quoted as saying, "Progress in science depends on new techniques, new discoveries, and new ideas, probably in that order" (McElheny, 2004, p. 71). In any field, from astronomy to zoology, new discoveries and ideas depend on good techniques and measurements. Psychologists' understanding has advanced furthest on topics such as sensory processes, learning, and memory, which are easiest to measure. Research progress has been slower in such areas as emotion and personality, where we struggle to find clear definitions and accurate measurements.

Confidence in the Conclusions Should Depend on the Strength of the Evidence

How much television should young children be allowed to watch per day? What should be the limits, if any, on teenagers playing violent video games? To what extent do the behavioral differences between men and women reflect biological influences? What is the best way to deal with the problem of violence in our society? How should parents react if a young child wants to change gender? You probably have opinions on questions like these, and so do many psychologists. However, the opinions are not always based on good evidence. When this text describes research studies in some detail, the reason is to explain how strong the research evidence is (or isn't) behind some conclusion.

Major Philosophical Issues in Psychology

Psychology began in the late 1800s as an attempt to apply scientific methods to questions about the philosophy of mind. Three of the most profound philosophical questions related to psychology are free will versus determinism, the mind–brain problem, and the nature–nurture issue.

Free Will versus Determinism

The scientific approach to anything, including psychology, assumes that we live in a universe of cause and effect. If things just happen for no reason at all, then we have no hope of discovering scientific principles. That is, scientists assume **determinism**, *the idea that every event has a cause, or determinant,*

Behavior is guided by external forces, such as the contour of the environment, and by forces within the individual. According to the determinist view, even those internal forces follow cause-and-effect laws.

that someone could observe or measure. At the level of subatomic particles, certain events apparently occur at random, but for events beyond the subatomic level, determinism seems to apply. Although determinism is an assumption, not a certainty, the success of scientific research attests to its value.

What about human behavior? According to the determinist assumption, everything we do has causes. This view seems to conflict with the impression all of us have that "I make the decisions about my actions. Often when I make a decision, it could have gone either way." *The belief that behavior is caused by a person's independent decisions* is known as **free will**. Do you think your behavior is predictable? How about other people's behavior? Questionnaires show that most people think their own behavior is less predictable than other people's. That is, you think you have free will, but other people, not so much (Pronin & Kugler, 2010).

Many psychologists maintain that free will is an illusion (Wegner, 2002): What you call a conscious intention is more a prediction than a cause of your behavior. When you have the experience of deciding to move a finger, the behavior has already started to happen, controlled unconsciously.

Other psychologists and philosophers reply that you do make decisions, in the sense that something within you initiates the action (Baumeister, 2008). When a ball bounces down a hill, its motion depends on the shape of the hill. When you run down a hill, you could change direction if you saw a car coming toward you, or a snake lying in your path. The ball could not.

Nevertheless, the "you" that makes your decisions is itself a product of your heredity and the events of your life. You did not create yourself. In a sense, yes, you do have a will, an ability to make choices (Dennett, 2003). However, your will is the product of your heredity and experiences. Whether you have or do not have free will depends on what you mean by "free."

The test of determinism is empirical: If everything you do has a cause, your behavior should be predictable, and psychological researchers should gradually improve their ability to make predictions. However, no one aspires to pinpoint accuracy. Psychologists' predictions are much like predicting the weather. The predictions can become gradually more accurate, but never completely accurate, simply because so many influences are operating.
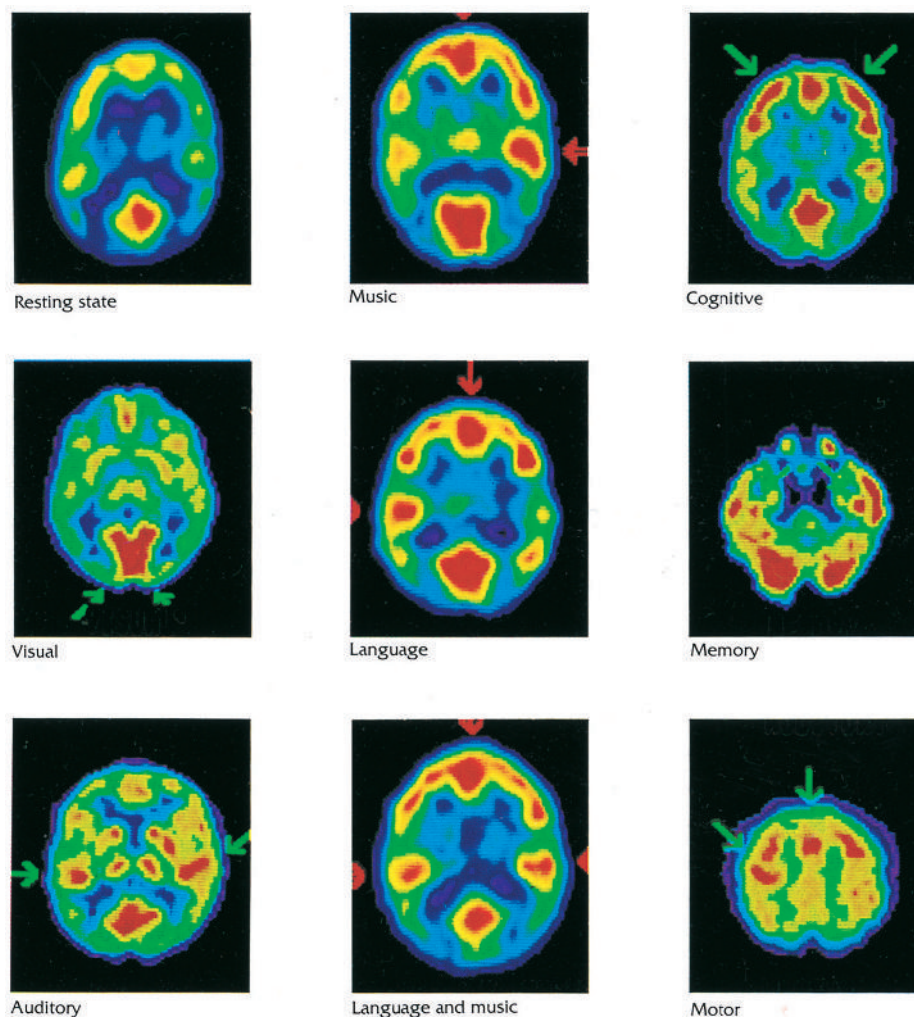
◄ **Figure 1.1** These PET scans show the brain activity of normal people during different activities. Red indicates the highest activity, followed by yellow, green, and blue. Arrows indicate the most active areas.

Resting state

Music

Cognitive

Visual

Language

Memory

Auditory

Language and music

Motor

Courtesy of Michael E. Phelps and John C. Mazziotta, University of California, Los Angeles, School of Medicine

The Mind–Brain Problem

Given that we live in a universe of matter and energy, what, if anything, is the mind? And why does consciousness exist? The *philosophical question of how experience relates to the brain* is the mind–brain problem (or mind–body problem). One view, called dualism, holds that *the mind is separate from the brain but somehow controls the brain and therefore the rest of the body*. However, dualism contradicts the law of conservation of matter and energy, one of the cornerstones of physics. According to that principle, the only way to influence any matter or energy, including the matter and energy that compose your body, is to act on it with other matter or energy. If the mind isn't composed of matter or energy, it cannot *do* anything. For that reason, nearly all brain researchers and philosophers favor monism, *the view that conscious experience is insepara-ble from the physical brain.* That is, mental activity *is* brain activity. So far as we can tell, consciousness cannot exist without brain activity, and presumably it is also true that certain kinds of brain activity do not exist without consciousness.

The photos in ▲ **Figure 1.1** show brain activity while someone participated in nine tasks, as measured by a technique called positron-emission tomography (PET). Red indicates the highest degree of brain activity, followed by yellow, green, and blue. As you can see, the various tasks increased activity in different brain areas, although all areas showed some activity at all times (Phelps & Mazziotta, 1985). You might ask: Did the brain activity cause the thoughts, or did the thoughts cause the brain activity? Brain re-searchers reply, "Neither," because brain activity and mental activity are the same thing.

Even if we accept this position, we are still far from understanding the mind–brain relationship. What type of brain activity is associated with con-sciousness? Why does conscious experience exist at all? Research studies are not about to put philoso-phers out of business, but results do constrain the philosophical answers that we can seriously consider.

The Nature–Nurture Issue

Why do most little boys spend more time than little girls with toy guns and trucks and less time with dolls? Is it because of biological differences or be-cause parents rear their sons and daughters different-ly? Alcohol abuse is common in some cultures and rare in others. Are these differences entirely a matter of social custom, or do genes influence alcohol use also? Why do people have different interests? Is it be-cause of their genetics or their history of experiences?

Why do different children develop different interests? They had different hereditary tendencies, but they also had different experiences. Separating the roles of nature and nurture is difficult.

Each of these questions relates to the **nature–nurture issue** (or heredity–environment issue): *How do differences in behavior relate to differences in heredity and environment?* The nature–nurture issue shows up in various ways throughout psychology, and it seldom has a simple answer.

concept check

1. **What is meant by monism?**
2. **What type of evidence supports monism?**

Answers

1. Monism is the theoretical statement that mental activity and brain activity are the same thing. 2. Every type of mental activity is associated with some type of measurable brain activity. It is also true that any type of brain damage leads to a deficit in some aspect of behavior or experience.

What Psychologists Do

We have considered some philosophical issues related to psychology, but most psychologists deal with smaller, more manageable questions. They work in many occupational settings, as shown in ▶ **Figure 1.2**. The most common settings are colleges and universities, private practice, hospitals and mental health clinics, and government agencies.

Service Providers to Individuals

It is important to distinguish among types of mental health professionals. The service providers for people with psychological troubles include clinical psychologists, psychiatrists, social workers, and counseling psychologists.

Clinical Psychology

Clinical psychologists *have an advanced degree in psychology (master's degree, doctor of philosophy [PhD], or doctor of psychology [PsyD]), with a specialty in understanding and helping people with psychological problems.* The problems range from depression, anxiety, and substance abuse to marriage conflicts, difficulties making decisions, or even the feeling that "I should be getting more out of life." Clinical psychologists try to understand the reason for the problems and then help the person overcome the difficulties. Some clinical psychologists are college professors and researchers, but most are full-time practitioners. A little over half of all new PhDs are for specialists in clinical psychology or other health-related fields.

Psychiatry

Psychiatry is a *branch of medicine that deals with emotional disturbances.* To become a psychiatrist, you must first earn a medical doctor (MD) degree and then take an additional four years of residency training in psychiatry. Because psychiatrists are medical doctors, they can prescribe drugs, such as antidepressants, whereas most psychologists cannot. In the United States, a few states now permit psychologists with a couple years of additional training to prescribe drugs. Psychiatrists are more likely than clinical psychologists to work in mental hospitals, and to treat clients with severe disorders.

▲ **Figure 1.2** Psychologists work in many settings. (Based on data from https://www.verywellmind.com/employment-of-psychologists-2794920, downloaded September 18, 2019.)

Table 1.1 Mental Health Professionals

Type of Therapist	Education
Clinical psychologist	PhD with clinical emphasis or PsyD plus internship. Ordinarily, 5+ years after undergraduate degree.
Psychiatrist	MD plus psychiatric residency. Total of 8 years after undergraduate degree.
Psychoanalyst	Psychiatry or clinical psychology plus additional training in a psychoanalytic institute. Many others who rely on Freudian methods also call themselves psychoanalysts.
Psychiatric nurse	From 2-year (AA) degree to master's degree plus supervised experience.
Clinical social worker	Master's degree plus 2 years of supervised experience.
Counseling psychologist	PhD, PsyD, or EdD plus supervised experience in counseling.
Forensic psychologist	Doctorate plus additional training in legal issues.

Does psychiatrists' ability to prescribe drugs give them an advantage over clinical psychologists? Not always. Drugs can be useful, but relying on them can be a mistake. Whereas a typical visit to a clinical psychologist includes an extensive discussion of the client's troubles, many visits to a psychiatrist focus almost entirely on checking the effectiveness of a drug and evaluating its side effects. A survey found that over the years, fewer and fewer psychiatrists have been providing talk therapy (Mojtabai & Olfson, 2008).

Other Mental Health Professionals

Several other kinds of professionals also provide help and counsel. **Psychoanalysts** are *therapy providers who rely heavily on the theories and methods pioneered by the early 20th-century Viennese physician Sigmund Freud and later modified by others.* Freud and his followers attempted to infer the hidden, unconscious, symbolic meaning behind people's words and actions, and psychoanalysts today continue that effort.

There is some dispute about who may rightly call themselves psychoanalysts. Some people apply the term to anyone who attempts to uncover unconscious thoughts and feelings. Others apply the term only to graduates of an institute of psychoanalysis, a program that lasts four years or more. These institutes admit mostly people who are already either psychiatrists or clinical psychologists. Thus, people completing psychoanalytic training will be at least in their mid-30s.

A **clinical social worker** *does work similar to a clinical psychologist but with different training.* In most cases, a clinical social worker has a master's degree in social work with a specialization in psychological problems. Many health maintenance organizations (HMOs) steer most of their clients with psychological problems toward clinical social workers instead of psychologists or psychiatrists because the social workers, with less formal education, charge less per hour. Some psychiatric nurses (nurses with additional training in psychiatry) provide similar services.

Counseling psychologists *help people make decisions about education, vocation, marriage, health maintenance, and other issues.* A counseling psychologist

has a doctorate degree (PhD, PsyD, or EdD) with supervised experience in counseling. Whereas a clinical psychologist deals mainly with anxiety, depression, and other emotional distress, a counseling psychologist deals mostly with life decisions and family or career readjustments. Counseling psychologists work in educational institutions, mental health centers, rehabilitation agencies, businesses, and private practice.

You may also have heard of **forensic psychologists**, *who provide advice and consultation to police, lawyers, and courts.* Forensic psychologists are clinical or counseling psychologists who have additional training in legal issues. They advise on such decisions as whether a defendant is mentally competent to stand trial or whether someone eligible for parole is dangerous (Otto & Heilbrun, 2002). Several popular films and television series have depicted forensic psychologists helping police investigators develop a psychological profile of a serial killer. That may sound like an exciting, glamorous profession, but few psychologists engage in such activities, and the accuracy of their profiles is uncertain. Most criminal profilers today have training and experience in law enforcement, not psychology.

■ **Table 1.1** compares various types of mental health professionals.

concept check

3. **How does the education of a clinical psychologist differ from that of a psychiatrist?**

Answers

3. A clinical psychologist earns an advanced degree in psychology, generally a PhD or PsyD. A psychiatrist earns an MD, like other medical doctors.

Service Providers to Organizations

Psychologists also work in business, industry, and school systems, doing work you might not recognize as psychology. The job prospects in these fields have been good, and you might find them interesting.

Industrial/Organizational Psychology

The psychological study of people at work is known as **industrial/organizational (I/O) psychology**. It deals with such issues as hiring the right person for a job, training people for jobs, developing work teams, determining salaries and bonuses, providing feedback to workers about their performance, planning an organizational structure, and organizing the workplace so that workers will be productive and satisfied. I/O psychologists attend to both the

individual workers and the organization, including the impact of economic conditions and government regulations.

Here's an example of a concern for industrial/organizational psychologists (Campion & Thayer, 1989): A company that manufactures complex electronic equipment needed to publish reference and repair manuals for its products. The engineers who designed the devices did not want to spend their time writing the manuals, and none of them were skilled writers anyway. So the company hired a technical writer to prepare the manuals. After a year, she received an unsatisfactory performance rating because the manuals she wrote contained too many technical errors. She countered that, when she asked various engineers in the company to check her manuals or to explain technical details to her, they were always too busy. She found her job complicated and frustrating. Her office was badly lit, noisy, and overheated, and her chair was uncomfortable. Whenever she mentioned these problems, she was told that she "complained too much."

In a situation like this, an industrial/organizational psychologist helps the company evaluate its options. One solution would be to fire her and hire an expert on electrical engineering who is also an outstanding writer who tolerates a badly lit, noisy, overheated, uncomfortable office. However, if the company cannot find or afford such a person, then it needs to improve the working conditions and provide the current employee with more training and help.

Human Factors

Learning to operate our increasingly complex machinery is one of the struggles of modern life. Mistakes can be serious. Imagine an airplane pilot who intends to lower the landing gear and instead raises the wing flaps, or a worker in a nuclear power plant who fails to notice a warning signal. A type of psychologist known as a **human factors specialist** or **ergonomist** *tries to facilitate the operation of machinery so that people can use it efficiently and safely.* Human factors specialists first worked in military settings, where complex technologies require soldiers to spot nearly invisible targets, understand speech through deafening noise, track objects in three dimensions, and make life-or-death decisions in a split second. The military turned to psychologists to redesign the tasks to fit the skills that their personnel could master.

Human factors specialists soon applied their expertise to the design of everyday devices, such as cameras, computers, microwave ovens, and cell phones. The field combines features of psychology, engineering, and computer science.

Human factors specialists help redesign machines to make them easier and safer to use. This field uses principles of both engineering and psychology.

Military Psychologists

Military psychologists are *specialists who provide services to the military.* Some are similar to industrial/organizational psychologists, conducting intellectual and personality tests to identify people suitable for certain jobs within the military, and then helping to train people for those jobs. Other military psychologists consult with the leadership about strategies, including the challenges of dealing with allies or enemies from a different culture. Still others provide clinical and counseling services to soldiers dealing with stressful experiences. Few experiences in life are more stressful than military combat. Some military psychologists conduct research on how to deal with battlefield stress, sleep deprivation, and other difficulties. Matthews (2014) has argued that military psychologists will become increasingly important, as future conflicts pertain more to influencing people than attacking them.

School Psychology

Many if not most children have school problems at one time or another. Some children have trouble sitting still or paying attention. Others get into trouble for misbehavior. Some have problems with reading or other academic skills. Others master their schoolwork quickly and become bored. They too need special attention.

School psychologists are *specialists in the psychological condition of students,* usually in kindergarten through high school. School psychologists identify children's educational needs, devise a plan to meet those needs, and then either implement the plan themselves or advise teachers how to implement it.

School psychology can be taught in a psychology department, an education department, or a department of educational psychology. In some countries, it is possible to practice school psychology with only a bachelor's degree. In the United States, the minimum education requirement for a school psychologist is usually a master's degree, but a doctorate may become necessary in the future. Most school psychologists work for a school system, but some work for mental health clinics, guidance centers, and other institutions.

Infants and young children will try to eat almost anything that tastes okay. As they grow older, they begin to avoid foods for reasons other than taste.

Community Psychology

Community psychologists *work as professors, researchers, program directors, or policy developers to promote mental health and well-being for a community, rather than working with one person at a time*. For example, instead of addressing the difficulties of one homeless person, a community psychologist might try to improve government policies about affordable housing. Instead of helping one person get to work, a community psychologist might try to improve public transportation for the neighborhood. The emphasis is on improving the social environment for the betterment of all, especially for people who have had limited opportunities.

Psychologists in Teaching and Research

Many psychologists, especially those who are not clinical psychologists, teach and conduct research in colleges and universities. To some extent, different kinds of psychologists study different topics. For example, developmental psychologists observe children, and biological psychologists examine the effects of brain damage. However, different kinds of psychologists sometimes study the same questions in different ways. To illustrate, let's consider one example: how we select what to eat. Different kinds of psychologists offer different explanations.

Developmental Psychology

Developmental psychologists *study how behavior changes with age,* "from womb to tomb." For example, they might examine language development from age 2 to 4 or memory from age 60 to 80, describing the changes and trying to explain them.

With regard to food selection, some taste preferences are present from birth. Newborns prefer sweet tastes, avoid bitter and sour substances, and appear to be indifferent to salty tastes, as if they could not yet taste them (Beauchamp, Cowart, Mennella, & Marsh, 1994). By about three months, they begin showing a preference for salty tastes (Liem, 2017). Toddlers will try to eat almost anything they can fit into their mouths, unless it tastes sour or bitter. For that reason, parents need to keep dangerous substances like furniture

polish out of toddlers' reach. Older children become increasingly selective about the foods they accept, but up to age 7 or 8, usually the only reason children give for refusing something is that they think it would taste bad (Rozin, Fallon, & Augustoni-Ziskind, 1986). As they grow older, they cite more complex reasons for rejecting foods, such as health concerns.

Because children are more sensitive to bitter tastes than adults are, and because most vegetables are at least slightly bitter, most children dislike vegetables, especially unfamiliar ones. Most medicines taste bitter. Adults swallow medicines in pills or capsules that are hard for young children to swallow. Getting young children to swallow a spoonful of bitter medicine is difficult, although adding a sweet taste usually helps (Mennella, Spector, Reed, & Coldwell, 2013).

Learning and Motivation

The research field of **learning and motivation** studies *how behavior depends on the outcomes of past behaviors and current motivations.* How often we engage in any particular behavior depends on the results of that behavior in the past.

We learn our food choices largely by learning what *not* to eat. For example, if you eat something and then feel sick, you form an aversion to the taste of that food, especially if it was unfamiliar. Thus, an important influence on food preferences is familiarity. Most of us like the foods we have eaten since childhood, and we gradually come to accept other foods as they become more familiar.

Cognitive Psychology

Cognition means *thought and knowledge.* A **cognitive psychologist** *studies those processes.* (The root *cogn* also shows up in the word *recognize,* which literally means "to know again.") Typically, cognitive psychologists focus on how people make decisions, solve problems, and convert their thoughts into language. These psychologists study both the best and the worst of human cognition (expert decision making and why people make costly errors).

Cognitive psychologists seldom study anything related to food selection, but cognitions about food do enter into our food decisions. For example, people often refuse an edible food just because of the very idea of it (Rozin & Fallon, 1987; Rozin, Millman, & Nemeroff, 1986). Most people in the United States refuse to eat meat from dogs, cats, or horses. Vegetarians reject all meat, not because they think it would taste bad, but because they dislike the idea of eating animal parts. On average, the longer people have been vegetarians, the more firmly they regard meat eating as wrong (Rozin, Markwith, & Stoess, 1997).

How would you like to try the tasty morsels in ▶ **Figure 1.3**? You might be repulsed by the idea of eating insects, even if they are guaranteed to be safe and nutritious (Rozin & Fallon, 1987). Would you be willing to drink a glass of apple juice after you watched someone dip a cockroach into it? What if the cockroach was carefully sterilized? Some people not only refuse to drink that particular glass of apple juice but also say they have lost their taste for apple juice in general (Rozin et al., 1986). Would you drink pure water from a brand-new, never-used toilet bowl? Would you eat a piece of chocolate fudge shaped like dog feces? If not, you are guided by the idea of the food, not its taste or safety.

▲ **Figure 1.3** Some cultures consider insects to be good food, whereas others consider them disgusting.

Biological Psychology

A **biopsychologist** or **behavioral neuroscientist** *explains behavior in terms of biological factors, such as activities of the nervous system, the effects of drugs and hormones, genetics, and evolutionary pressures.* How would a biological psychologist approach the question of how people (or animals) select foods?

One factor in taste preferences is that some people have up to three times as many taste buds as others do, mostly for genetic reasons. People with the most taste buds usually have the least tolerance for strong tastes, including black coffee, black breads, hot peppers, grapefruit, radishes, and Brussels sprouts (Bartoshuk, Duffy, Lucchina, Prutkin, & Fast, 1998; Drewnowski, Henderson, Short, & Barratt-Fornell, 1998). Most of them also dislike foods that are too sweet (Yeomans, Tepper, Rietzschel, & Prescott, 2007). However, exceptions occur, especially because of familiarity. Even if you have a high density of taste buds, you may have come to enjoy familiar strong-tasting foods.

If you ate corn dogs and cotton candy and then got sick on a wild ride, something in your brain would blame the food, regardless of what you think consciously. This kind of learning helps us avoid harmful substances.

Hormones also affect taste preferences. Many years ago, one child showed a strong craving for salt. As an infant, he often licked the salt off crackers and bacon without eating the food itself. He put a thick layer of salt on everything he ate. Sometimes he swallowed salt directly from the shaker. At the age of $3\frac{1}{2}$, he had to go to a hospital, and while he was there, he received only the usual hospital fare. He soon died of salt deficiency (Wilkins & Richter, 1940).

The reason was that he had defective adrenal glands, which secrete the hormones that enable the body to retain salt. He craved salt because he had to consume it fast enough to replace what he lost in his urine. (Too much salt is bad for your health, but too little salt is also dangerous.) Later research confirmed that salt-deficient animals immediately show an increased preference for salty tastes (Rozin & Kalat, 1971). Becoming salt deficient causes salty foods to taste especially good (Jacobs, Mark, & Scott, 1988). People often report salt cravings after losing salt by bleeding or sweating, and many women crave salt during menstruation or pregnancy.

Evolutionary Psychology

An **evolutionary psychologist** *tries to explain behavior in terms of the evolutionary history of the species, including why evolution might have favored a tendency to act in particular ways.* For example, why do people and other animals crave sweets and avoid bitter tastes? Here, the answer is easy: Most sweets are nutritious and almost all bitter substances are poisonous (T. R. Scott & Verhagen, 2000). Ancient animals that ate fruits and other sweets survived to become our ancestors.

However, although some evolutionary explanations of behavior are persuasive, others are less certain (de Waal, 2002). The brain is a product of evolution, just as any other organ is, but the research challenge is to separate the evolutionary influences on our behavior from what we have learned during a lifetime.

Social Psychology and Cross-Cultural Psychology

Social psychologists *study how an individual influences other people and how the group influences an individual.* For example, on average, we eat about twice as much when we dine in a large group as we do when eating alone (de Castro, 2000). If you invite guests to your house, you offer them something to eat or drink as a way to strengthen a social relationship.

Cross-cultural psychology *compares the behavior of people from different cultures.* Comparing cultures is central to determining what is characteristic of humans in general and what depends on our background.

Cuisine is one of the most stable and defining features of any culture. In one study, researchers interviewed Japanese students who had spent a year in another country as part of an exchange program. The students' satisfaction with their year abroad had little relationship to the educational system, religion, family life, recreation, or dating customs of the host country. The main determinant of their satisfaction was the food: Students who could sometimes eat Japanese food had a good time. Those who could not became homesick (Furukawa, 1997).

The similarity between the words *culture* and *agriculture* is no coincidence, as cultivating crops was a major step toward civilization. We learn from our culture what to eat and how to prepare it (Rozin, 1996). Consider, for example, cassava, a root vegetable that is poisonous unless someone washes and pounds it for three days to remove the cyanide. Can you imagine discovering that fact? Someone in South America long ago had to say, "So far, everyone who ate this plant died, but I bet that if I wash and pound it for three days, then it will be okay." Once someone made that amazing discovery, culture passed it on to later generations and eventually to other continents.

■ **Table 1.2** summarizes some of the major fields of psychology, including several that have not been discussed.

concept check

4. **Which type of psychologist helps companies hire the right people for a job and then train them?**
5. **Why do many menstruating women crave potato chips?**
6. **Which type of psychologist studies how people influence one another's behavior?**

Answers

6. Social psychologist

5. By losing blood, they also lose salt, and a deficiency of salt triggers a craving for salty tastes.

4. Industrial/organizational psychologist

Cassava, a root vegetable native to South America, is now a staple food in much of Africa as well. It grows in climates not suitable for most other crops. However, people must pound and wash it for days to remove the cyanide.

GC Stock/Alamy Stock Photo

Should You Major in Psychology?

On average, students who major in engineering, math, or one of the natural sciences get higher-paying jobs than students who major in other fields (Rajecki & Borden, 2011). What seems an obvious explanation is that the math and science fields teach important information and skills. Yes, but also consider a second explanation: Students who major in math or a natural science must be willing to work hard. No one majors in physics or chemistry expecting it to be easy. Students who work hard in college are also likely to work hard on the job, even if the job has little to do with physics or chemistry. The point is, whatever you choose as your major, get into the habit of working hard at it.

About 25 to 30 percent of students with a bachelor's degree in psychology take jobs related to psychology, such as personnel work or social services. Even for those who take seemingly unrelated jobs, a psychology background is helpful by teaching people to evaluate evidence, organize and write papers, handle statistics, listen carefully to what people say, and respect cultural differences. Those skills are important for almost anything you might do.

Almost half of students majoring in psychology continue with post-graduate education, including medical school, dental school, law school, divinity school, or other professional schools. A psychology major is compatible with preparation for many fields of post-graduate study, although you should check the specific course requirements for your goals.

Suppose you want a career as a psychologist. The educational requirements vary among countries, but in the United States and Canada, nearly all jobs in psychology require education beyond a bachelor's degree. People with a master's degree can get jobs in mental health or educational counseling, but in most states, they must work under the supervision of someone with a doctorate. People with a PhD (doctor of philosophy) in clinical psychology or a PsyD (doctor of psychology) degree can provide mental health services. The main difference between the PhD and PsyD degrees is that the PhD includes an extensive research project, leading to a dissertation, whereas the PsyD degree does not. PsyD programs vary strikingly, including some that are academically strong and others with low standards (Norcross, Kohout, & Wicherski, 2005). A college teaching or research position almost always requires a PhD. An increasing percentage of doctorate-level

Table 1.2 Some Major Specializations in Psychology

Specialization	General Interest	Example of Interest or Research Topic
Biopsychologist	Relationship between brain and behavior	What body signals indicate hunger and satiety?
Clinical psychologist	Emotional difficulties	How can people be helped to overcome severe anxiety?
Cognitive psychologist	Memory, thinking	Do people have several kinds of memory?
Community psychologist	Organizations and social structures	Would improved job opportunities decrease psychological distress?
Counseling psychologist	Helping people make important decisions	Should this person consider changing careers?
Developmental psychologist	Changes in behavior over age	At what age can a child first distinguish between appearance and reality?
Educational psychologist	Improvement of learning in school	What is the best way to test a student's knowledge?
Environmental psychologist	How factors such as noise, heat, and crowding affect behavior	What building design can maximize the productivity of the people who use it?
Evolutionary psychologist	Evolutionary history of behavior	How did people evolve their facial expressions of emotion?
Human factors specialist	Communication between person and machine	How can an airplane cockpit be redesigned to increase safety?
Industrial/organizational psychologist	People at work	Should jobs be made simple and foolproof or interesting and challenging?
Learning and motivation specialist	Learning in humans and other species	What are the effects of reinforcement and punishment?
Personality psychologist	Personality differences	Why are certain people shy and others gregarious?
Psychometrician	Measuring intelligence, personality, interests	How fair are current IQ tests? Can we devise better tests?
School psychologist	Problems that affect schoolchildren	How should the school handle a child who regularly disrupts the classroom?
Social psychologist	Group behavior, social influences	What methods of persuasion are most effective for changing attitudes?

psychologists now work in business, industry, and the military doing research related to practical problems.

For more information about majoring in psychology, prospects for graduate school, and a great variety of jobs for psychology graduates, visit the website of the American Psychological Association.

in closing | module 1.1

Types of Psychologists

Psychology researchers, clinical psychologists, human factors specialists, and industrial/organizational psychologists are all psychologists, even though their daily activities have little in common. What unites psychologists is a dedication to progress through research.

The discussion in this module has been simplified in several ways. In particular, biological psychology, cognitive psychology, social psychology, and the other fields overlap significantly. Nearly all psychologists combine insights and information gained from several approaches. Many like to hyphenate their

self-description to emphasize the overlap. For example, "I'm a social-developmental-cognitive neuroscientist."

As we proceed through this book, we shall consider one type of behavior at a time and, generally, one approach at a time. That is simply a necessity. No one can talk intelligently about many topics at once. But bear in mind that all these processes do ultimately fit together. What you do at any given moment depends on a great many influences.

Summary

- *What is psychology?* Psychology is the systematic study of behavior and experience. Psychologists deal with both theoretical and practical questions. (page 3)
- *Three general themes.* First, "it depends." That is, almost any aspect of behavior varies as a function of many influences, and a good psychologist becomes attentive to even subtle points that alter how we act and think. Second, research progress depends on good measurement. Third, we need to distinguish between strongly supported and weakly supported conclusions. (page 3)
- *Determinism–free will.* Determinism is the view that everything, including human behavior, has a physical cause. The scientific approach rests on the assumption of determinism. (page 4)
- *Mind–brain.* According to nearly all philosophers and neuroscientists, mental activity and brain activity are inseparable. (page 5)
- *Nature–nurture.* Behavioral differences relate to differences in both heredity and environment. The relative contributions of nature and nurture vary from one instance to another. (page 5)

- *Psychology and psychiatry.* Clinical psychologists have a PhD, PsyD, or master's degree. Psychiatrists are medical doctors. Both clinical psychologists and psychiatrists treat people with emotional problems, but psychiatrists can prescribe drugs and other medical treatments, whereas in most states, psychologists cannot. Counseling psychologists help people deal with difficult decisions, and less often deal with psychological disorders. (page 6)
- *Service providers to organizations.* Nonclinical fields of application include industrial/organizational psychology, human factors, military psychology, school psychology, and community psychology. (page 7)
- *Research fields in psychology.* Subfields of psychological research include biological psychology, learning and motivation, cognitive psychology, developmental psychology, and social psychology. (page 9)
- *Job prospects.* People with a bachelor's degree in psychology enter a wide variety of careers or continue their education in professional schools. Those with an advanced degree in psychology have additional possibilities depending on their area of specialization. (page 11)

Key Terms

biopsychologist (or behavioral neuroscientist) (page 10)

clinical psychologist (page 6)

clinical social worker (page 7)

cognition (page 9)

cognitive psychologist (page 9)

community psychologist (page 9)

counseling psychologist (page 7)

cross-cultural psychology (page 10)

determinism (page 4)

developmental psychologist (page 9)

dualism (page 5)

evolutionary psychologist (page 10)

forensic psychologist (page 7)

free will (page 4)

human factors specialist (or ergonomist) (page 8)

industrial/organizational (I/O) psychology (page 7)

learning and motivation (page 9)

military psychologist (page 8)

mind–brain problem (page 5)

monism (page 5)

nature–nurture issue (page 6)

psychiatry (page 6)

psychoanalyst (page 7)

psychology (page 3)

school psychologist (page 8)

social psychologist (page 10)

Review Questions

1. Scientific research in psychology and other fields relies on which of these assumptions?
   (a) All people are born with an equal probability of success.
   (b) People choose their behaviors by free will.
   (c) We live in a universe of cause and effect.
   (d) Science can solve all of humanity's problems.

2. Mind–body dualism conflicts with which of these physical principles?
   (a) The law of gravity
   (b) The conservation of matter and energy
   (c) Einstein's theory of general relativity
   (d) Quantum mechanics

3. How do clinical psychologists differ from psychiatrists?
   (a) They have different education.
   (b) They follow different theories.
   (c) They have different amounts of experience.
   (d) They do different types of research.

4. What distinguishes psychoanalysts from other types of therapists?
   (a) Psychoanalysts try to explain behavior in terms of brain activity.
   (b) Psychoanalysts follow methods and theories originated by Freud.
   (c) Psychoanalysts work only in mental hospitals.
   (d) Psychoanalysts work only in prisons.

5. Which of these is a major concern for human factors psychologists?
   (a) Explaining why people differ in their food preferences
   (b) Observing behavior changes "from womb to tomb"
   (c) Measuring intelligence and personality differences
   (d) Making machinery easier to use

6. Which of these is a major concern for community psychologists?
   (a) Providing mental health care to everyone in a community
   (b) Helping people move from one place to another.
   (c) Changing the environment to help disadvantaged people
   (d) Making machinery easier to use

7. What type of psychologist is most concerned to understand thinking, knowledge, and problem solving?
   (a) Cognitive psychologists
   (b) Developmental psychologists
   (c) Human factors specialists
   (d) Biopsychologists

Answers: 1c, 2b, 3a, 4b, 5d, 6c, 7a.

After studying this module, you should be able to:

1. Explain why early psychologists were eager for a "great man" or great theory to revolutionize the field.

2. Describe the research interests of the earliest psychologists.

3. List differences between psychology in its early days and psychology today.

4. Explain why early psychologists avoided the study of conscious experience.

Imagine yourself as a young scholar in 1880. You decide to become a psychologist because you are excited about the field's new scientific approach. Like other early psychologists, you have a background in either biology or philosophy.

So far, so good. But what questions will you address? A good research question is interesting and answerable. How would you choose a research topic? You cannot get research ideas from a psychological journal because the first issue won't be published until the following year (in German). You cannot follow in the tradition of previous researchers because there haven't *been* any. You are on your own. In the next pages, we shall explore changes in what psychologists considered good research topics, including projects that dominated psychology for a while and then faded. ▼ **Figure 1.4** outlines some major historical events inside and outside psychology.

The Early Era

Psychological research uses the scientific method, but psychology differs from other sciences in several ways. One of those ways is our history. Astronomy, physics, chemistry, and biology began with centuries of contributions by amateurs who devoted part of their leisure time to observing animals, observing the stars, or conducting simple experiments. By the late 1700s or early 1800s when universities first offered courses in chemistry, physics, and biology, the first professors in those fields already had a substantial amount of information they could teach.

In contrast, psychology began as a deliberate attempt to start a new science. In the late 1800s, several scholars proposed to start a new field of psychology that would apply the methods of the natural sciences to the philosophical questions of mind. Universities supported this optimistic project and before long, many of them hired professors to teach this new science of psychology. However, unlike chemistry or biology, hardly anyone had done amateur research in psychology. What were the early psychology professors going to teach? People today sometimes say that psychology is just common sense. When you finish your study of introduction to psychology, you can form your own judgment about that claim, but back around 1900, it was definitely true. The first English-language textbook of psychological science devoted almost half its pages to what biologists had discovered about vision, hearing, and the other senses (Scripture, 1907). At least that gave psychology professors something to teach.

And so, academic psychology began with an inferiority complex. Early psychology professors eagerly awaited the coming of a great man—yes, "man," as apparently no one imagined that it might be a great woman—who would revolutionize psychology. It was like the prediction of a Messiah.

A review of psychology's early history (Borch-Jacobsen & Shamdasani, 2012) quoted one psychologist who spoke of "a great chance for some future psychologue to make a name greater than Newton's," another one who anticipated that a great psychologist's name will "join those of Copernicus and Darwin," and another who said that "the present psychological situation calls out for a new Darwin of the mind." In their eagerness for that great revolutionary of psychology, early psychologists nominated several of their contemporaries as being that great man. Theodore Flournoy (1903) wrote that if future research confirms the results of Frederic Myers, then Myers would be one of the greats, right up there with Copernicus and Darwin. Unfortunately, future research could not confirm any of Myers's results. That's right, not any of them.

Sigmund Freud immodestly nominated himself as the counterpart to Copernicus and Darwin, largely because he said his ideas were resisted, just as theirs had been (Freud, 1915/1935,[1] p. 252). Most psychologists today reject that analogy. Copernicus and Darwin faced opposition based on religion, whereas the opposition to Freud came mostly from psychologists and psychiatrists—the people in the best position to evaluate his theories.

In any case, early psychology was a highly ambitious field. The hope was to amass knowledge that would quickly become comparable to the impressive accomplishments of chemistry, physics, and biology.

Wilhelm Wundt and the First Psychological Laboratory

A few people had conducted a small amount of psychological research, dating back to the nearly forgotten work of Ferdinand Ueberwasser in 1783 (Schwarz & Pfister, 2016). Nevertheless, the work of Wilhelm Wundt ("Voont") beginning in 1879 in Leipzig, Germany, is recognized as the start of scientific psychology. Wundt's interests were wide-ranging (Zehr, 2000), but one of his goals was to find the elements of experience, comparable to those of chemistry. Psychology's elements were, he maintained, sensations and feelings (Wundt, 1896/1902). At any moment, you might experience the taste of a fine meal, the sound of good music, and a certain degree of pleasure. These elements

[1] A reference citation containing a slash between the years, such as this one, refers to a book originally published in the first year (1915) and reprinted in the second year (1935).
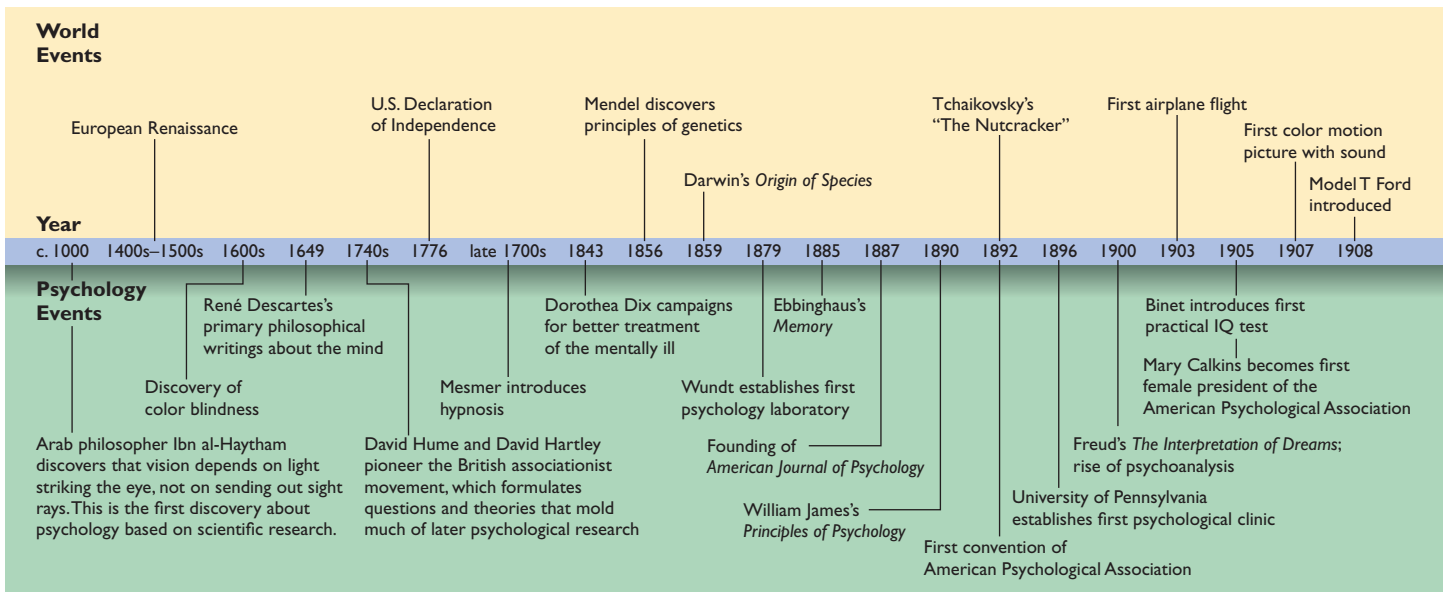
▲ **Figure 1.4** Dates of some important events in psychology and elsewhere. (Based partly on Dewsbury, 2000)

would merge into a compound that was your experience. Furthermore, Wundt maintained, your experience is partly under your voluntary control, because you can shift your attention from one element to another and get a different experience. To test his idea about the components of experience, Wundt presented various kinds of lights, textures, and sounds, and asked subjects to report the intensity and quality of their sensations. That is, he asked them to **introspect**—*to look within themselves.* He recorded the changes in people's reports as he changed the stimuli.

In one of Wundt's earliest studies, he set up a pendulum that struck metal balls and made a sound at two points on its swing. People would watch the pendulum and indicate where it appeared to be when they heard the sound. On average, people reported the pendulum to be about an eighth of a second in front of or behind the ball when they heard the strike (Wundt, 1862/1961). Wundt's interpretation was that a person needs about an eighth of a second to shift attention from one stimulus to another.

Wundt and his students were prolific investigators, and the brief treatment here cannot do him justice. He wrote more than 50,000 pages about his research, but his main impact came from setting the precedent of collecting scientific data to answer psychological questions.

Edward Titchener and Structuralism

At first, most of the world's psychologists received their education from Wundt himself. One of his students, Edward Titchener, came to the United States in 1892 as a psychology professor at Cornell University. Like Wundt, Titchener believed that the main question of psychology was the nature of mental experiences.

Titchener (1910) typically presented a stimulus and asked his subject to analyze it into its separate features—for example, to look at a lemon and describe its yellowness, brightness, shape, and other characteristics. He called his approach **structuralism**, *an attempt to describe the structures that compose the mind,* particularly sensations, feelings, and images. Imagine you are the psychologist: I look at a lemon and try to tell you my experience of its brightness separately from my experience of its yellowness, shape, and other aspects.

Here is the problem. How do you know whether my reports are accurate? After Titchener died in 1927, psychologists abandoned both his questions and his methods. Why? Remember that a good scientific question is both interesting

Edward Titchener asked subjects to describe their sensations. For example, they might describe their sensation of shape, their sensation of color, and their sensation of texture while looking at a lemon.

A historical timeline with events above and below a central date line.

Events above the line (world history):

- Rise in use of radio — c. 1910
- World War II
- First demonstration of television
- Founding of Alcoholics Anonymous
- First electronic digital computer
- Watson and Crick discover the structure of DNA
- *Brown v. Board of Education* decision orders integration of U.S. public schools
- Introduction of Salk polio vaccine
- Soviet Union launches first space satellite
- J. F. Kennedy assassinated
- M. L. King, Jr.'s, "I Have a Dream" speech
- Onset of AIDS epidemic
- Human genome mostly mapped
- Terrorist attacks in United States

Date line: c. 1910 | 1911 | 1919 | 1920s | 1928 | 1935 | 1938 | 1939–45 | 1946 | 1948 | 1950s | 1953 | 1954 | 1955 | 1956 | 1963 | 1975 | 1981 | 1980s | 1994 | 2000 | 2001 | 2002

Events below the line (psychology history):

- Pavlov discovers classical conditioning
- Bleuler publishes first good description of schizophrenia
- Thorndike's first studies of operant conditioning
- J. B. Watson's *Psychology from the Standpoint of a Behaviorist*; rise of behaviorism
- Spread and popularization of clinical psychology
- B. F. Skinner's *Behavior of Organisms*
- Kinsey publishes first extensive survey of human sexual behavior
- Introduction of drugs to combat schizophrenia and depression
- Rise of humanistic psychology
- Discovery of REM sleep stage
- Birth of cognitive psychology
- Milgram's first studies on obedience
- Elizabeth Loftus's early work on memory distortions
- Sperry, Hubel, and Wiesel share Nobel Prize for discoveries about brain and behavior
- Publication of *DSM-IV*, standard manual for diagnosis of mental illness
- Beginning of empirical research on consciousness
- Baillargeon, Rovee-Collier, DeLoache, and others demonstrate greater than expected abilities of human infants
- Daniel Kahneman wins Nobel Prize in Economics for studies of decision making

and answerable. Regardless of whether Titchener's questions about the elements of the mind were interesting, they seemed unanswerable.

William James and Functionalism

In the same era as Wundt and Titchener, Harvard University's William James articulated some of the major issues of psychology and earned recognition as the founder of American psychology. James's book *The Principles of Psychology* (1890) defined many of the questions that still dominate psychology today.

James had little patience with searching for the elements of the mind. He focused on what the mind *does* rather than what it *is.* That is, instead of seeking the elements of consciousness, he preferred *to learn how people produce useful behaviors.* For this reason, we call his approach functionalism. He suggested the following examples of good psychological questions (James, 1890):

- How can people strengthen good habits?
- Can someone attend to more than one item at a time?
- How do people recognize that they have seen something before?
- How does an intention lead to action?

James proposed possible answers but did little research of his own. His main contribution was to inspire later researchers to address the questions that he posed.

The Search for the Laws of Learning

Early psychologists eventually lost hope in the arrival of the great man who would revolutionize psychology and instead began to seek simple laws of learning, analogous to the laws of physics. If they could state laws with mathematical precision and use them to predict behavior, then psychology would be as impressive as other sciences.

Many researchers set out to study animal learning. Just as physicists could study gravity by dropping any object in any location, many psychologists in the mid-1900s assumed they could learn all about learning by studying any one example, such as rats in mazes. A highly influential psychologist, Clark Hull, wrote, "One of the most persistently baffling problems which confronts modern psychologists is the finding of an adequate explanation of the phenomena of maze learning" (1932, p. 25). Another early psychologist, Edward Tolman, wrote, "I believe that everything important in psychology (except perhaps . . . such matters as involve society and words) can be investigated in essence through the continued experimental and theoretical analysis of the determiners of rat behavior at a choice-point in a maze" (1938, p. 34).

Clark Hull offered the most influential attempt at a systematic theory of learning. He started with the hypothesis that learned habit strength linking a stimulus to a response ($_sH_R$) approaches its maximum (equal to 1) as a function of N, the number of trials, and a, an empirical variable—that is, one that we have to measure because it varies

Early psychological researchers studied rats in mazes. As they discovered that this behavior was more complicated than they supposed, their interest turned to other topics.

from one situation to another and even from one individual to another. According to Hull, $_sH_R = 1 - (10^{-a}N)$. But behavior also depends on drive (D), another empirical variable. It also depends on stimulus intensity, incentive motivation, inhibition, and oscillation. So Hull added more terms to his equation. As research progressed, the theory became more and more complicated, with more and more empirical variables. In fact, it was getting more complicated faster than it was getting more accurate—a bad sign for any theory.

Still, psychological research of the mid-1900s continued trying to explain virtually all behavior in terms of reinforcements and punishments. For example, one hypothesis held that how often you say something depends on previous reinforcements for similar speech. To test this idea, researchers might say "mm hmm" or "good" every time you said a short sentence, or a long sentence, or an adverb, or a word referring to yourself, or whatever else they wanted to increase, to see whether they could get you to increase that type of utterance. For a few years, this was a popular type of research.

Eventually most psychologists grew weary of this approach. Decades of research had gone into an effort with not much payoff. From today's perspective, you might find much research from the mid-1900s to be tedious. Still, we should give those researchers credit for being ambitious. They were trying to develop grand theories to explain as much of behavior as possible. If you browse through today's psychology journals, you will find many interesting studies, but few attempts to build a general theory of behavior.
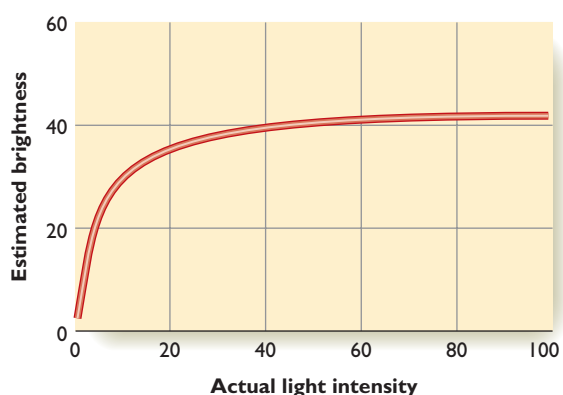
concept check

7. **Why did psychologists of the mid-1900s spend so much time studying rats in mazes?**
8. **In what way is psychology today less ambitious than it was in the early 1900s?**

Answers

7. They hoped to discover general principles of learning that they could state mathematically.

8. In the early 1900s, psychologists were eager for someone to revolutionize psychology just as Darwin revolutionized biology. Somewhat later researchers tried to develop general laws of learning that would explain as much as possible. After decades of such research, they became discouraged with seeking general, widespread laws.

Studying Sensation

In the late 1800s and early 1900s, psychologists paid little attention to abnormal behavior, leaving it to psychiatrists. They devoted much of their research to the study of vision and other sensations. Why? One reason was that they wanted to understand mental experience, and experience consists of sensations. Another reason was that it makes sense to start with relatively easy, answerable questions. Sensation was certainly easier to study than, say, personality.

Early psychologists demonstrated differences between physical stimuli and psychological perceptions. For example, a light that is twice as intense as another one does not look twice as bright. ◀ Figure 1.5 shows the relationship between the intensity of light and its perceived brightness. *The mathematical description of the relationship between the physical stimulus and its perceived properties* is called the **psychophysical function** because it relates psychology to physics. Such research demonstrated the feasibility of scientific research on psychological questions.

Darwin and the Study of Animal Intelligence

Charles Darwin's theory of evolution by natural selection (Darwin, 1859, 1871) had an enormous impact on psychology as well as biology. Darwin argued that humans and other species share a remote common ancestor. If so, then other animals should share features in common with humans, including some degree of intelligence.

Based on this implication, early **comparative psychologists**, *specialists who compare different animal species,* did something that seemed more reasonable then than it does now: They set out to measure animal intelligence. They set various species to such tasks as the delayed-response problem and the detour problem. In the *delayed-response problem,* an animal sees or hears a signal indicating where it can find food. After the signal, the animal is restrained for a delay to see how long the animal remembers the signal (see ▼ Figure 1.6). In the *detour problem,* an animal is separated from food by a barrier to see whether it takes a detour away from the food to reach it (▼ Figure 1.7).

▲ Figure 1.5 This graph relates the perceived intensity of light to its physical intensity. When a light becomes twice as intense physically, it does not seem twice as bright. (Adapted from Stevens, 1961)

Ultrashock/Shutterstock
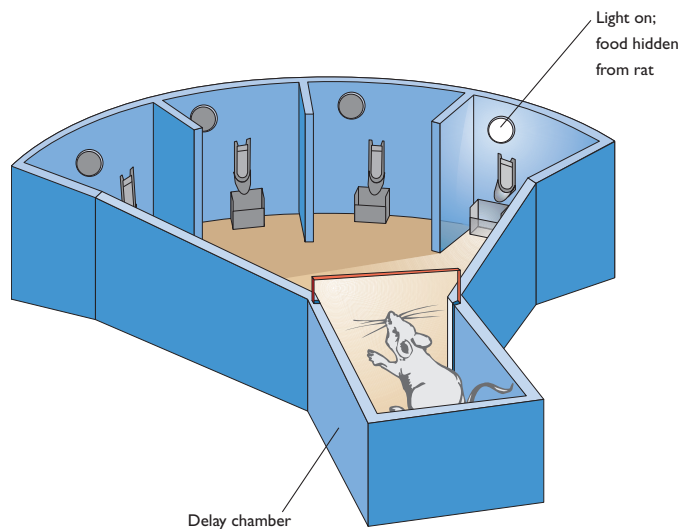
▲ **Figure 1.6** Early comparative psychologists assessed animal intelligence with the delayed-response problem. Variations on this task are still used today with humans as well as laboratory animals.

▲ **Figure 1.7** In the detour problem, an animal must go away from the food before it can move toward it.

However, measuring animal intelligence turned out to be more difficult than it sounded. A species might seem dull-witted on one task but brilliant on another. For example, zebras are generally slow to learn to approach one pattern instead of another for food, unless the patterns happen to be narrow stripes versus wide stripes, in which case they excel (Giebel, 1958) (see ▼ **Figure 1.8**). Rats don't learn to find food hidden under the object that looks different from the others, but they easily learn to choose the object that *smells* different from the others (Langworthy & Jennings, 1972). Eventually, psychologists decided that the relative intelligence of nonhuman animals was a pointless question.

Comparative psychologists today continue to study animal learning, but the emphasis has changed. The questions are now, "What can we learn from animal studies about the mechanisms of behavior?" and "How did each species evolve the behavioral tendencies it shows?"

Measuring Human Intelligence

While some psychologists studied animal intelligence, others examined human intelligence. Francis Galton, a cousin of Charles Darwin, was among the first to try to measure intelligence and to try to explain intellectual variations. Galton was fascinated with measurement (Hergenhahn, 1992). For example, he invented the weather map, measured degrees of boredom during lectures, suggested the use of fingerprints to identify individuals, and—in the name of science—attempted to measure the beauty of women in different countries.

In an effort to determine the role of heredity in human achievement, Galton (1869/1978) examined whether the sons of famous and accomplished men tended to become eminent themselves. (Women in 19th-century England had little opportunity for fame.) Galton found that the sons of judges, writers, politicians, and other notable men had a high probability of similar accomplishment themselves. He attributed this edge to heredity. (Do you think he had adequate evidence for his conclusion? If the sons of famous men become famous themselves, is heredity the only explanation?)

Galton tried to measure intelligence using simple sensory and motor tasks, but his measurements were unsatisfactory. In 1905, a French researcher named Alfred Binet devised the first useful intelligence test. Intelligence testing became common in many countries. Psychologists, inspired by the popularity of intelligence tests, developed tests of personality, interests, and other characteristics.
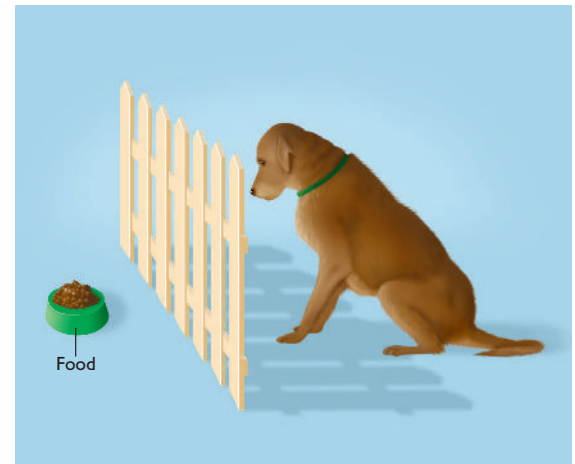
Much research goes into trying to make psychological tests fair and accurate.

From Freud to Modern Clinical Psychology

The Austrian psychiatrist Sigmund Freud revolutionized and popularized psychotherapy with his methods of analyzing patients' dreams and memories. He tried to trace current behavior to early childhood experiences, including children's sexual fantasies. Freud was a persuasive speaker and writer, and his influence was enormous. By the mid-1900s, most psychiatrists in the United States and Europe were following his methods. However, Freud's influence in psychology has faded substantially since then.

Until the mid-1900s, only psychiatrists provided treatment for mental illness. However, the number of returning soldiers needing help after the horrors of World War II overwhelmed the capacities of the limited number of psychiatrists. At that point, clinical psychology as we now know it began to develop. In order to improve therapy, psychologists have conducted extensive research and have developed new, more effective methods.

concept check

9. Why did clinical psychology become more prominent around the middle of the 1900s?

Answer
9. Soldiers returning after World War II needed more help than the limited number of psychiatrists could provide. Clinical psychologists began providing treatment at that time.

▲ **Figure 1.8** Zebras learn rapidly when they have to compare stripe patterns (Giebel, 1958).

Recent Trends

Recall that some of the earliest psychological researchers wanted to study the conscious mind but became discouraged with Titchener's introspective methods. Since the 1960s, cognitive psychology (the study of thought and knowledge) has gained in prominence. Although cognitive psychologists sometimes ask people to describe their thoughts, more often they measure the accuracy and speed of responses to draw inferences about the underlying processes.

Another rapidly growing field is neuroscience. New techniques of brain scanning now enable researchers to examine brain activity without opening the skull. Today, neuroscience influences nearly every aspect of psychology. Evolutionary psychology is another new emphasis. Animals that behaved in certain ways survived, reproduced, and became our ancestors. Those whose behaviors did not lead to reproductive success failed to pass on their genes. In some cases, we can infer the selective pressures that led to our current behaviors.

For many decades, researchers interested in personality concentrated mostly on what can go wrong, such as fear, anger, and sadness. The newer field of **positive psychology** *studies the predispositions and experiences that make people happy, productive, and successful.*

New fields of application have also arisen. Health psychologists study how people's health is influenced by their behaviors, such as smoking, drinking, sexual activities, exercise, diet, and reactions to stress. They also try to help people change their behaviors to promote better health. Sports psychologists apply psychological principles to help athletes set goals, train, and concentrate their efforts.

Psychologists today have also broadened their scope to include more of human diversity. In its early days, around 1900, psychology was more open to women than most other academic disciplines were, but even so, the opportunities for women were limited (Milar, 2000). Mary Calkins, an early memory researcher, regarded as Harvard's best psychology graduate student, was nevertheless denied a PhD because of Harvard's tradition of granting degrees only to men (Scarborough & Furomoto, 1987). She did, however, serve as president of the American Psychological Association, as did Margaret Washburn, another important woman in the early days of psychology.

Today, women receive nearly three-fourths of the new PhDs in psychology and hold many leadership roles in psychological organizations. An increasing percentage of PhDs go to blacks, Hispanics, or other minorities, although much room remains for further progress in seeking diversity (National Science Foundation, 2015).

What will psychology be like in the future? A few likely trends are foreseeable. Because advances in medicine have enabled people to live longer, the psychology of aging is increasingly important. Because of depletion of natural resources and climate change, people will need to change their way of life in many ways. Persuading people to change their behavior is a task for both politicians and psychologists.

in closing | module 1.2

Psychology through the Years

Throughout the early years of psychology, many psychologists devoted enormous efforts to projects that produced disappointing results, such as Titchener's search for the elements of the mind. Not all the efforts of early psychologists were fruitless, and in other chapters, you will encounter many classic studies that we still regard highly. Still, if some past psychologists spent their time on projects we now consider misguided, can we be sure that many of today's psychologists aren't on the wrong track?

We cannot, of course. Of all the theories and research projects that we now respect most dearly, some will stand the test of time and others will not. That is not a reason for despair. Much like a rat in a maze, researchers make progress by trial and error. They advance in a certain direction; sometimes it leads to progress, and sometimes it leads to a dead end. But even exploring a dead end and eliminating it is progress. Even when research doesn't lead to clear answers, at least it leads to better questions.

Summary

- *Origin of psychology.* Psychology began as a deliberate attempt to start a new science that would apply the methods of the natural sciences to the questions of philosophy of mind. (page 15)
- *Psychology's early ambitions.* Many universities appointed psychology professors before psychologists had much to teach. The early days were marked by an impatient eagerness for great theories that would rival those of the natural sciences. (page 15)
- *First research.* In 1879, Wilhelm Wundt established the first laboratory devoted to psychological research. (page 15)
- *Limits of self-observation.* One of Wundt's students, Edward Titchener, attempted to analyze the elements of mental experience, relying on people's own observations. Other psychologists became discouraged with this approach. (page 16)
- *Functionalism.* William James, the founder of American psychology, focused attention on useful behavior rather than on the contents of the mind. He outlined many questions for future researchers. (page 17)
- *The search for laws of learning.* For decades, the search for general laws of learning dominated psychological research. The hope was to state laws that would apply to as much of behavior as possible. This effort was highly ambitious, but eventually most researchers became discouraged with the enterprise. (page 17)
- *Early sensory research.* In the late 1800s and early 1900s, many researchers concentrated on studies of the senses, partly because sensation is central to mental experience. (page 18)
- *Darwin's influence.* Charles Darwin's theory of evolution by natural selection prompted interest in the intelligence of non-human animals. (page 18)
- *Intelligence testing.* The measurement of human intelligence was a concern of early psychologists that has persisted to the present. (page 19)
- *Freud.* Sigmund Freud's theories heavily influenced the early development of psychotherapy, although other methods are more widespread today. (page 19)
- *Clinical psychology.* At one time, psychiatrists provided nearly all the care for people with psychological disorders. After World War II, clinical psychology began to assume much of this role. (page 19)

Key Terms

comparative psychologist (page 18)

functionalism (page 17)

introspect (page 16)

positive psychology (page 20)

psychophysical function (page 18)

structuralism (page 16)

Review Questions

1. Why did psychology professors of the early 1900s have less information to teach than biology or chemistry professors?
   - (a) Textbook publishers at that time concentrated on the natural sciences.
   - (b) Structuralists and functionalists were hostile to each other.
   - (c) Biology and chemistry had a tradition of amateur research.
   - (d) Ethics committees at the time prohibited research on humans.

2. Which of these topics was a major research topic for the earliest psychologists?
   - (a) Vision and other sensations
   - (b) Mental illness
   - (c) Racial prejudice
   - (d) Expert problem solving

3. What is the objection to using introspection as a research method?
   - (a) Introspection requires complex and expensive equipment.
   - (b) Introspection research requires large numbers of participants.
   - (c) Ethics committees usually forbid the use of introspection.
   - (d) We have no way to check the accuracy of introspection.

4. Why did psychological researchers of the mid-1900s devote so much research to rats in mazes?
   - (a) Mazes were the best way to test the theories of structuralism.
   - (b) The researchers were trying to help control rat infestations in major cities.
   - (c) The researchers sought general laws of behavior.
   - (d) The researchers could not get permission to do research on humans.

5. What is a psychophysical function?
   (a) A machine that measures brain activity during a perceptual task
   (b) A mathematical statement relating perception to physical stimuli
   (c) A device that produces a series of increasing or decreasing stimuli
   (d) An explanation of how people make practical use of sensory information

6. What does a comparative psychologist compare?
   (a) Theories
   (b) Animal species
   (c) Parts of the brain
   (d) Languages

7. What historical event led to the rise of clinical psychology?
   (a) World War II
   (b) The Civil Rights protests era
   (c) The translation of Freud's works into English
   (d) The invention and wide use of computers

Answers: 1c, 2a, 3d, 4c, 5b, 6b, 7a.

2

Scientific Methods in Psychology

Years ago, I was watching a Discovery Channel documentary about elephants. After the narrator discussed the enormous amount of food they eat, he started on their digestive system. He commented that the average elephant passes enough gas in a day to propel a car for 20 miles (32 km). I thought, "Wow, isn't that amazing!" and I told a couple of people about it.

Later I started to think, "Wait a minute. *Who measured that?* Did someone attach a balloon to an elephant's rear end and collect gas for 24 hours? And then put it into a car and drive it? Was that a full-sized car or an economy car? City traffic or highway? How do they know they measured a typical elephant? Did they determine the mean for a broad sample of elephants?" My doubts quickly grew.

"Oh, well," you might say. "Who cares?" You're right. How far someone could propel a car on elephant gas doesn't matter. However, my point is not to ridicule the makers of this documentary but to ridicule *me*. Remember, I said I told two people about this claim before I started to doubt it. For decades, I had taught students to question assertions and evaluate the evidence, and here I was, uncritically accepting a silly statement and telling other people, who for all I know, may have gone on to tell other people. The point is that all of us yield to the temptation to accept unsupported claims, and we all need to discipline ourselves to question the evidence, especially evidence supporting claims that we would like to believe. This chapter concerns evaluating evidence in psychology.

Yakobchuk Viacheslav/Shutterstock.com

After studying this module, you should be able to:

1. Discuss the importance of replicable results.

2. Contrast falsifiability with burden of proof.

3. Explain why scientists seek the most parsimonious explanation of any result.

4. Explain why most psychologists are skeptical of claims of extrasensory perception.

What constitutes an explanation? Consider the following quote ("The Medals and the Damage Done," 2004, p. 604):

> In 2002, [Michael] Brennan was a British national rowing champion. . . . As the UK Olympic trials loomed, Brennan was feeling confident. But . . . for much of the past 12 months, Brennan's performance has been eroded by constant colds, aching joints and fatigue. . . . When the trials rolled round this April, Brennan . . . finished at the bottom of the heap. "I couldn't believe it," he says. To an experienced sports doctor, the explanation is obvious: Brennan has "unexplained underperformance syndrome" (UPS).

What do you think? Is "unexplained underperformance syndrome" an *explanation?* Consider other examples: Birds fly south for the winter "because they have an instinct." Certain people get into fights "because they are aggressive." Certain students have trouble paying attention "because they have attention deficit disorder." Are these statements explanations? Or are they no better than unexplained underperformance syndrome? A good explanation goes beyond giving something a name, and finding good explanations requires good research.

Psychological Science

The word *science* derives from a Latin word meaning "knowledge." Science is a way of carefully gaining, testing, and evaluating knowledge. Psychological research follows scientific methods.

Gathering Evidence

Research starts with careful observation. The science of astronomy consists almost entirely of observation and measurement. (It is difficult to conduct experiments on stars and planets!) For a psychological example, Robert Provine (2000) studied laughter by visiting shopping malls and recording who laughed and when.
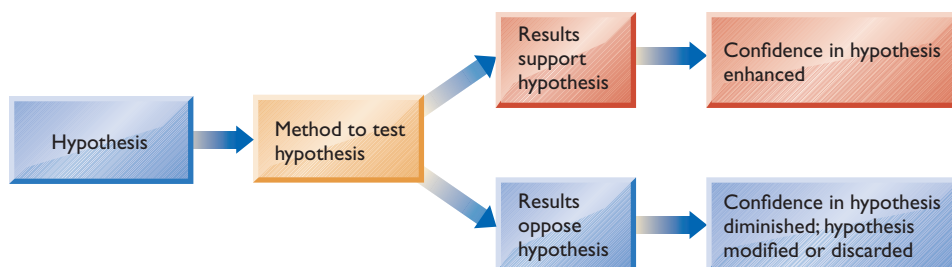
Good observations and measurements often suggest a pattern that leads to a **hypothesis**, which is *a clear predictive statement*, often an attempt to explain the observations. A test of a hypothesis goes through the series of steps described in the following four sections and illustrated in ▼ **Figure 2.1**. Articles in most scientific publications follow this sequence, too. In every chapter of this book other than the introductory chapter, you will find at least one psychological study described in a section entitled "What's the Evidence?" Each of those goes through the sequence from hypothesis to interpretation.

Hypothesis

A hypothesis can start with observations, such as noticing that some children who play violent video games are themselves aggressive. You might then form a hypothesis that imagining violence leads to actual violence. A good hypothesis leads to predictions. For example, "if we let children play violent video games, they will behave more aggressively," or "if we decrease the availability of violent video games, the crime rate will decrease."

Method

Any hypothesis could be tested in many ways. One way to test the effects of violent video games would be to examine whether children who play them more often act more violently themselves. However, that type of research does not tell us about cause and effect: Does playing a violent game lead to violence? Or is it simply that people who are already violent like to play those games?

A better method is to take a set of children, such as those attending a summer camp, randomly assign them to two groups, give them different types of video games (which we hope hold children's attention equally well), and then see whether the group playing more violent games behaves more aggressively. One limitation is that researchers control the

◀ **Figure 2.1** An experiment tests the predictions that follow from a hypothesis. Results either support the hypothesis or indicate a need to revise or abandon it.

children's activities for only a few days. Still another limitation is the ethical restraint against studying anything more than minor acts of aggression.

Because any method has strengths and weaknesses, researchers vary their methods. If studies using different methods all point to the same conclusion, we increase our confidence in the conclusion. A single study is almost never decisive.

Results

Fundamental to any research is measuring the outcome. A phenomenon such as "violent behavior" is tricky to measure. Do threats count? Does verbal abuse? When does a push or shove cross the line between playfulness and violence? It is important for an investigator to set clear rules about measurements. After making the measurements, the investigator determines whether the results are impressive enough to call for an explanation or whether the apparent trends might have been due to chance.

Because we have been using violent video games as the example, you are probably curious about the outcome. Analyses of the many studies of this topic, using many research methods, suggest that playing violent video games leads to a small increase in children's aggressive behaviors, on average (Ferguson, 2015; Furuya-Kanamori & Doi, 2016). However, researchers more easily publish results that support a predicted relationship than those failing to support it, and psychologists are still debating how much of the apparent effect depends on that "publication bias" (Hilgard, Engelhardt, & Rouder, 2017; Kepes, Bushman, & Anderson, 2017).

Interpretation

Researchers' final task is to consider what the results mean. If the results contradict the hypothesis, researchers should abandon or modify the original hypothesis. If the results match the prediction, investigators gain confidence in the hypothesis, but they also should consider other hypotheses that fit the results.

Replicability

Most scientific researchers are scrupulously honest in stating their methods and results. One reason is that anyone who reports a scientific study must include the methods in enough detail for other people to repeat the procedure and, we hope, get similar results. Someone who reports results falsely runs a risk of being caught, and therefore distrusted from then on.

Replicable results are *those that anyone can obtain, at least approximately, by following the same procedures.* Scientists do make certain allowances for small effects. For example, one method of

teaching might work better than another, but only slightly, so the advantage might not appear in all studies. When researchers try to verify a small effect, they use a meta-analysis, *which combines the results of many studies as if they were all one huge study.* A meta-analysis also determines which variations in procedure increase or decrease the effects. However, if no one finds conditions under which the phenomenon occurs fairly consistently, we do not take it seriously. This rule may seem harsh, but it is our best defense against error.

Consider an example of a nonreplicable result. In the 1960s and early 1970s, several researchers trained rats to do something, chopped up the rats' brains, extracted certain chemicals, and injected those chemicals into untrained animals. The recipients then apparently remembered what the first group of rats had learned to do. From what we know of brain functioning, theoretically this procedure shouldn't work, but if it did, imagine the possibilities. Some people proposed, semiseriously, that someday you could get an injection of European history or introduction to calculus instead of going to class. Alas, the results were not replicable. When other researchers repeated the procedures, most of them found no effect from the brain extracts (L. T. Smith, 1974).

Psychological researchers have become increasingly concerned about the replicability of their findings. We shall consider the issue in more detail in the second module of this chapter.

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concept check

1. **Suppose several studies report some result, whereas several others do not. The studies vary in size, quality, and results. How do we decide whether the results support the hypothesis?**

Answer

1. Someone may conduct a meta-analysis that combines all studies as if they were one large study.

Evaluating Scientific Theories

If replicable data support a hypothesis, eventually researchers propose a theory. In science, a theory is not just a guess. It is *an explanation or model that fits many observations and makes accurate predictions.* A good theory starts with as few assumptions as possible and leads to many correct predictions. In that way, it reduces the amount of information we must remember. The periodic table in chemistry is an excellent example: From the information about the elements, we can predict the properties of an enormous number of compounds.

One important reason for scientific progress is that scientists generally agree on how to evaluate theories. Whereas most people can hardly imagine evidence that would change their religious or political views, scientists can generally imagine evidence that would make them abandon or modify their favorite theories. (Oh, not always, of course. Some people can be stubborn.)

Falsifiability and Burden of Proof

The philosopher Karl Popper emphasized scientists' willingness to disconfirm their theories by saying that the purpose of research is to find which theories are *incorrect.* That is, the point of research is to *falsify* the incorrect theories, and a good theory is one that withstands all attempts to falsify it. It wins by a process of elimination.

A well-formed theory is falsifiable—that is, *stated in such clear, precise terms that we can see what evidence would count against it*—if, of course, such evidence existed. For example, the theory of gravity makes precise predictions about falling objects. Because people have tested these predictions many times, and none of the observations have disconfirmed the predictions, we have high confidence in the theory.

This point is worth restating because "falsifiable" sounds like a bad thing. Falsifiable does not mean we actually have evidence against a theory. (If we did, it would be falsi*fied*.) Falsifiable means we can *imagine* a result that would contradict the theory. If a theory makes no definite prediction, it is not falsifiable. For example, many physicists believe that ours is just one among a huge number, perhaps an infinite number, of other universes. Can you imagine any evidence *against* that view? If not, it is not a good theory (Steinhardt, 2014). For a psychology example, Sigmund Freud claimed that all dreams are motivated by wish fulfillment. If you have a happy dream, it appears to be a wish fulfillment. However, if you have an unhappy dream, then Freud claimed that a censor in your brain disguised the wish. As Domhoff (2003) noted, Freud stated his theory in such a way that any observation counted for it or at least not against it (see ▶ Figure 2.2). If no possible observation could falsify the theory, it is too vague to be useful.

However, when Popper wrote that research is *always* an attempt to falsify a theory, he went too far. "All objects fall" (the law of gravity) is falsifiable. "Some objects fall" is not falsifiable, although it is certainly true—a pitifully weak statement, but nevertheless true. If "some objects fall" *were* false, you could not *demonstrate* it to be false!

Instead of insisting that all research is an effort to falsify a theory, another approach is to discuss **burden of proof**, *the obligation to present evidence to support one's claim.* In a criminal trial, the burden of proof is on the prosecution. If the prosecution does not make a convincing case, the defendant goes free. The reason is that the prosecution should be able to find convincing evidence if someone is guilty, but in many cases innocent defendants could not possibly demonstrate their innocence.

Similarly, in science, the burden of proof is on anyone who makes a claim that should be demonstrable, if it is true. For the claim "some objects fall," the burden of proof is on anyone who supports the claim. (It's easy to fulfill that burden of proof, of course.) For the claim "every object falls," we cannot expect anyone to demonstrate it to be true for every object, and so the burden of proof is on someone who doubts the claim. We continue to believe the statement unless someone shows an exception. For a claim such as "UFOs from outer space have visited Earth" or "some people have psychic powers to perceive things without any sensory information," the burden of proof is on anyone who supports these statements. If they are true, someone should be able to show clear evidence.

Parsimony

What do we do if several theories fit the known facts? Suppose you notice that a picture on your wall is hanging on an angle. You consider four explanations:

- The ground shook when a truck drove by.
- A gust of wind moved the picture.
- One of your friends bumped it without telling you.
- A ghost moved it.

All four explanations fit the observation, but we don't consider them on an equal basis. When given a choice among explanations that seem to fit the facts, we prefer the one whose assumptions are fewer, simpler, or more consistent with what we already know. This is known as the principle of **parsimony** (literally "stinginess") or *Occam's razor* (after the philosopher William of Occam). The principle of parsimony is a conservative idea: We stick with ideas that work and try as hard as we can to avoid new assumptions (e.g., ghosts).

Parsimony and Degrees of Open-Mindedness

The principle of parsimony tells us to adhere to what we already believe, to resist radically new hypotheses. You might protest: "Shouldn't we remain

gremlin/E+/Getty Images

▲ **Figure 2.2** According to Freud, every dream is based on wish fulfillment. If a dream seems unhappy, it is because a censor in your head disguised the wish. Can you imagine any observation that would contradict this theory?

open-minded to new possibilities?" Yes, if open-mindedness means a willingness to consider proper evidence, but not if it means that "anything has as much chance of being true as anything else." The stronger the reasons behind a current opinion, the more evidence you should need before replacing it.

For example, many people have attempted to build a "perpetual motion machine," one that generates more energy than it uses. ▼ **Figure 2.3** shows an example. The U.S. Patent Office is officially closed-minded on this issue, refusing even to consider patent applications for such machines. Physicists are convinced, both for logical reasons and because of consistent observations, that any work wastes energy, and that keeping a machine going always requires energy. If someone shows you what appears to be a perpetual motion machine, look for a hidden battery or other power source. If you don't find one, assume that you overlooked it. A claim as extraordinary as a perpetual motion machine requires extraordinary evidence.

Let's consider a couple of examples from psychology in which people have claimed very surprising results. Although it is fair to examine the evidence, it is also important to maintain a skeptical attitude and look as closely as possible for a simple, parsimonious explanation.

Applying Parsimony: Clever Hans, the Amazing Horse

Early in the 20th century, Wilhelm von Osten, a German mathematics teacher, set out to demonstrate the intellectual ability of his horse, Hans. To teach Hans arithmetic, he first showed him an object, said "one," and lifted Hans's foot. He raised Hans's foot twice for two objects and so on. With practice, Hans learned to look at a set of objects and

tap the correct number of times. Soon it was no longer necessary for Hans to see the objects. Von Osten would just call out a number, and Hans would tap the appropriate number.

Mr. von Osten moved on to addition and then to subtraction, multiplication, and division. Hans caught on quickly, soon responding with 90 to 95 percent accuracy. Then von Osten and Hans began touring Germany, giving public demonstrations. Hans's abilities grew until he could add fractions, convert fractions to decimals or decimals to fractions, do algebra, tell time to the minute, and give the values of German coins. Using a letter-to-number code, he could spell the names of objects and identify musical notes such as B-flat. (Evidently, he had perfect pitch.) He was usually correct even when questions were put to him by people other than von Osten, with von Osten out of sight.

Given this evidence, many people were ready to believe that Hans had great intellectual powers. But others sought a more parsimonious explanation. Oskar Pfungst (1911) observed that Hans could answer a question correctly only if the questioner knew the answer. Apparently, the questioner was giving away the answer. Also, Hans was accurate only when the questioner stood in plain sight.

Eventually, Pfungst observed that anyone who asked Hans a question would lean forward to watch Hans's foot. Hans had learned to start tapping whenever someone stood next to his forefoot and leaned forward. After Hans reached the correct number of taps, the questioner would give a slight upward jerk of the head and a change in facial expression, anticipating that this might be the last tap. Even skeptical scientists who tested Hans did this involuntarily. After all, they thought, wouldn't it be exciting if Hans got it right? Hans simply continued tapping until he saw that cue.

In short, Hans was indeed a clever horse, but we do not believe that he understood mathematics. Pfungst demonstrated that he could explain Hans's behavior in the parsimonious terms of responses to facial expressions, and therefore, no one needed to assume anything more complex.

Applying Parsimony: Extrasensory Perception

The possibility of **extrasensory perception (ESP)** has long been controversial in psychology. Supporters of extrasensory perception claim that *some people sometimes acquire information without receiving any energy through any sense organ.* Supporters claim that people with ESP can identify someone else's thoughts (telepathy) even from a great distance and despite barriers that would block any known form of energy. Supporters also claim that certain people can perceive objects that are hidden
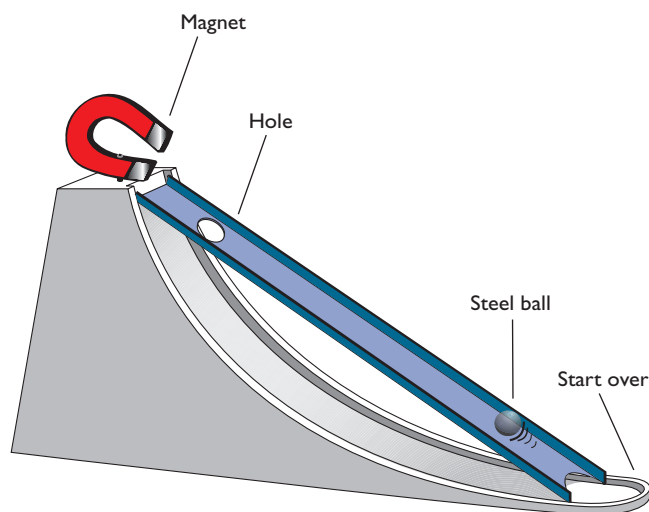
▲ **Figure 2.3** A proposed perpetual motion machine: The magnet pulls the metal ball up the inclined plane. When the ball reaches the top, it falls through the hole and returns to its starting point, from which the magnet will again pull the ball up. Can you see why this device is sure to fail? (See answer A on page 32.)

from sight (clairvoyance), predict the future (precognition), and influence such physical events as a roll of dice by mental concentration (psychokinesis).

Accepting any of these claims would require us not only to overhaul major concepts in psychology but also to discard the most fundamental tenets of physics. What evidence is there for ESP?

Anecdotes

Anecdotes are people's reports of isolated events, such as a dream or hunch that comes true. Such experiences often seem impressive, but they are not scientific evidence. Sooner or later, amazing coincidences are sure to occur, and people tend to remember them. On February 29, 1964, two North Carolina high school basketball teams played a game that lasted 13 overtimes, the
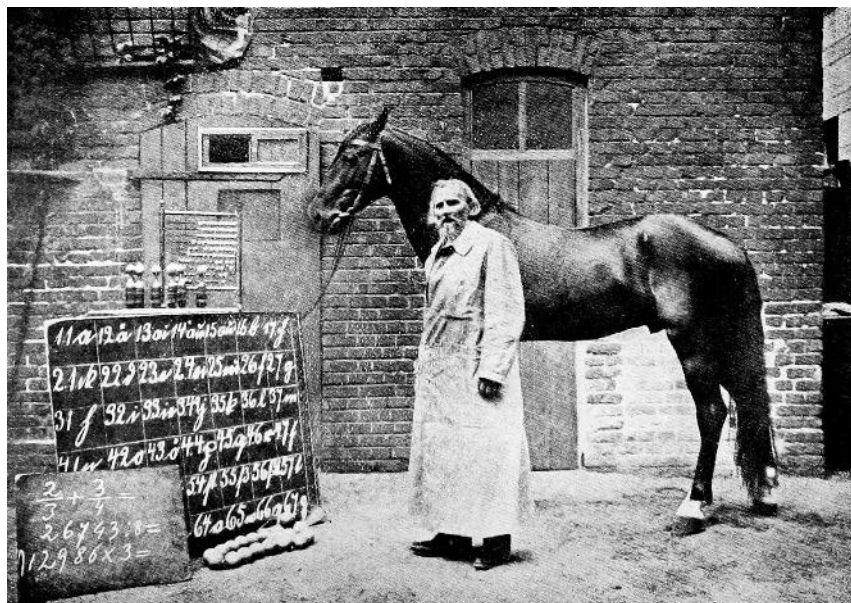
Clever Hans and his owner, Mr. von Osten, demonstrated that the horse could answer complex mathematical questions with great accuracy. The question was, "How?" (After Pfungst, 1911, in Fernald, 1984.)

► Figure 2.4 According to the followers of Nostradamus, each of these statements is a specific prophecy of a 20th-century event (Cheetham, 1973). What do you think the prophecies mean? Compare your answers to answer B on page 32.

1. The great man will be struck down in the day by a thunderbolt. An evil deed, foretold by the bearer of a petition. According to the prediction another falls at night time. Conflict at Reims, London, and pestilence in Tuscany.

2. When the fish that travels over both land and sea is cast up on to the shore by a great wave, its shape foreign, smooth, and frightful. From the sea the enemies soon reach the walls.

3. The bird of prey flying to the left, before battle is joined with the French, he makes preparations. Some will regard him as good, others bad or uncertain. The weaker party will regard him as a good omen.

4. Shortly afterwards, not a very long interval, a great tumult will be raised by land and sea. The naval battles will be greater than ever. Fires, creatures which will make more tumult.

longest high-school game ever. Meanwhile on the same night, two Tennessee high school basketball teams played a game that lasted 9 overtimes, tied for the third longest ever. Wow, what are the odds against that? Well, this is the wrong question. The odds against that particular coincidence may be high, but this was just one of an incalculably huge number of coincidences that could have occurred, somewhere, sometime. In fact, we should expect unlikely coincidences to happen fairly often.

Furthermore, we tend to remember, discuss, and exaggerate the hunches and dreams that come true, while we forget the ones that don't. We could evaluate anecdotal evidence only if people recorded their hunches and dreams *before* the possible events.

You may have heard of the "prophet Nostradamus," a 16th-century French writer who allegedly predicted many events of later centuries. ▲ **Figure 2.4** presents four samples of his writings. All of his predictions are at this level of vagueness. After something happens, people imaginatively reinterpret his writings to fit the event. (If we don't know what a prediction means until *after* it occurs, is it really a prediction?)

Professional Psychics

Various stage performers claim to read other people's minds and perform other amazing feats. The Amazing Kreskin prefers to talk of his "extremely sensitive" rather than "extrasensory" perception (Kreskin, 1991). Still, part of his success as a performer comes from allowing people to believe he has uncanny mental powers.

After carefully observing Kreskin and others, David Marks and Richard Kammann (1980) concluded that they used the same kinds of deception commonly employed in magic acts. For example, Kreskin sometimes begins his act by asking the audience to read his mind. Let's try to duplicate this trick right now: Try to read my mind. I am thinking of a number between 1 and 50. Both digits are odd numbers, but they are not the same. For example, it could be 15 but it could not be 11. (These are the instructions Kreskin gives.) Have you chosen a number? Please do.

Dum, dum, da, dum. . . I am waiting for you to think of a number.

All right, my number was 37. Did you think of 37? If not, how about 35? You see, I started to think 35 and then changed my mind, so you might have got 35.

If you successfully "read my mind," are you impressed? Don't be. At first, it seemed that you had many numbers to choose from (1 to 50), but by the end of the instructions, you had only a few. The first digit had to be 1 or 3, and the second had to be 1, 3, 5, 7, or 9. You eliminated 11 and 33 because both digits are the same, and you probably eliminated 15 because I cited it as a possible example. That

leaves only seven possibilities. Most people stay far away from the example given and tend to avoid the highest and lowest possible choices. That leaves 37 as the most likely choice and 35 as the second most likely.

Magician Lance Burton can make people and animals seem to suddenly appear, disappear, float in the air, or do other things that we know are impossible. Even if we don't know how he accomplishes these feats, we take it for granted that they are based on methods of misleading the audience.

Second act: Kreskin asks the audience to write down something they are thinking about while he walks along the aisles talking. Then, back on stage, he "reads people's minds." He might say something like, "Someone is thinking about his mother. . . ." In any large crowd, someone is bound to shout, "Yes, that's me. You read my mind!" On occasion he describes in great detail something that someone has written. Generally, that person was sitting along the aisle where Kreskin was walking.

After a variety of other tricks (see Marks & Kammann, 1980), Kreskin goes backstage while the mayor or some other dignitary hides Kreskin's paycheck somewhere in the audience. Then Kreskin comes back, walks up and down the aisles, across the rows, and eventually shouts, "The check is here!" The rule is that if he guesses wrong, then he does not get paid. (He hardly ever misses.)

How does he do it? It is a Clever Hans trick. Kreskin studies people's faces. Most people want him to find the check, so they get more excited as he gets close to it and more disappointed or distressed

Radivoke Lajic holds six rocks that he claims are meteorites that struck his house.

Europics/Newscom

if he moves away. In effect they are saying, "Now you're getting closer" and "Now you're moving away." Gradually he closes in on the check.

concept check ✔

2. **Are the predictions by Nostradamus falsifiable?**
3. **Radivoke Lajic from Bosnia has six rocks that he claims are meteorites that hit his house at different times. He claims aliens from outer space are attacking him. Can you think of an alternative explanation for his rocks? If so, why is your interpretation better than his?**

Answer

2. No. Because their meaning is unclear, no observation could contradict them.
3. Perhaps they are just stones from Earth. Even if they are meteorites, he may have bought them somewhere. These explanations are preferable because they are more parsimonious.

Experiments

Because anecdotes and stage performances occur under uncontrolled conditions, they are nearly worthless as scientific evidence. Laboratory experiments provide the only evidence about ESP worth serious consideration.

Over the years, researchers have tried many procedures, including guessing the order of a deck of cards, guessing numbers generated by a random-number generator, and describing a remote setting that someone else is viewing. In each case, initial studies generated excitement that subsided after other researchers failed to replicate the findings. For example, in the *ganzfeld* procedure (from German words meaning "entire field"), a "sender" views a photo or film, selected at random from four possibilities, and a "receiver" in another room is asked to describe the sender's thoughts and images. Typically, the receiver wears half Ping-Pong balls over the eyes and listens to static noise through earphones to minimize normal stimuli that might overpower the presumably weak extrasensory stimuli (see ▼ **Figure 2.5**). Later, a judge examines a transcript of what the receiver said and compares it to the four photos or films, determining which one it matches most closely. On average, it should match the target about one in four times. If a receiver "hits" more often than one in four, we can calculate the probability of accidentally doing that well. One review reported that 6 of the 10 laboratories using this method found positive results (Bem & Honorton, 1994). However, 14 later studies from 7 laboratories failed to find evidence that differed from chance (Milton & Wiseman, 1999).

In 2011, a prestigious journal published a series of studies claiming to show that people can foresee the future (Bem, 2011). In one study, college students clicked on the left or right side of the screen to predict which side would show a picture. After the guess, the computer randomly chose one side or the other. If it matched the student's guess, it displayed an erotic photograph of a couple engaged in a sex act. The experimenter reported that students' guesses matched the computer's choice 53 percent of the time, suggesting an ability to predict the future. In another of the studies, students read a list of words, tried to recall them, and then studied half of the list again. The report was that the students remembered more of the words that they studied again after the recall test. That is, you could improve your score on a test by studying the material after the test was over! (If you believe this can work, you are welcome to try it.)

Before you revise your study habits, however, you should know that other psychologists have noted many problems and oddities in both the research procedures and the statistical analysis of results (Alcock, 2011; Rouder & Morey, 2011). Also, researchers at seven universities repeated the procedures exactly, using thousands of participants, and failed to find any hint of an effect (Galak, LeBoeuf, & Nelson, 2012; Ritchie, Wiseman, & French, 2012). Another lab tried a modified procedure and also failed to find any benefit from studying again after the test (Traxler, Foss, Polali, & Zirnstein, 2012). Given the long history of promising but unreplicable results, most psychologists remain skeptical of all ESP claims.

The lack of replicability is one major reason to be skeptical of ESP, but another reason is parsimony. If someone claims that a horse does mathematics or a person foresees random events, we should search thoroughly for a simple explanation.

◄ **Figure 2.5** In the ganzfeld procedure, a "receiver," who is deprived of most normal sensory information, tries to describe the photo or film that a "sender" is examining.

Fortean/TopFoto/The Image Works

in closing | module 2.1

Scientific Thinking in Psychology

What have we learned about science in general? Science does not deal with proof or certainty. All scientific conclusions are tentative and are subject to revision. Nevertheless, this tentativeness does not imply that it is okay to abandon well-established theories without excellent reasons.

Scientists always prefer the most parsimonious theory. Before they accept any claim that requires a major new assumption, they insist that it be supported by replicable experiments that rule out simpler explanations and by a new theory that is clearly superior to the theory it replaces.

Summary

- *Steps in a scientific study.* A scientific study goes through the following sequence of steps: hypothesis, method, results, and interpretation. Because almost any study is subject to more than one possible interpretation, we base our conclusions on a pattern of results from many studies. (page 25)
- *Replicability.* The results of a given study are taken seriously only if other investigators following the same method obtain similar results. (page 26)
- *Falsifiability and burden of proof.* A good theory should be stated in a way that makes it falsifiable. That is, we should be able to imagine an observation that would contradict it. In any

dispute, the side that should be capable of presenting clear evidence has the obligation to do so. (page 26)
- *Parsimony.* All else being equal, scientists prefer the theory that relies on simpler assumptions, or assumptions consistent with other theories that are already accepted. (page 27)
- *Skepticism about extrasensory perception.* Psychologists carefully scrutinize any claims of extrasensory perception, because the evidence reported so far has been unreplicable, and because the scientific approach includes a search for parsimonious explanations. (page 28)

Key Terms

burden of proof (page 27)

extrasensory perception (ESP) (page 28)

falsifiable (page 26)

hypothesis (page 25)

meta-analysis (page 26)

parsimony (page 27)

replicable result (page 26)

theory (page 26)

Answers to Other Questions in the Module

A. Any magnet strong enough to pull the metal ball up the inclined plane would not release the ball when it reached the hole at the top. It would pull the ball across the hole. (page 28)

B. The prophecies of Nostradamus (see page 29), as interpreted by Cheetham (1973), refer to the following: (1) the assassinations of John F. Kennedy and Robert F. Kennedy, (2) Polaris ballistic missiles shot from submarines, (3) Hitler's invasion of France, and (4) World War II.

Review Questions

1. The term "replicable" applies to which step in a research study?
   - (a) The hypothesis
   - (b) The results
   - (c) The interpretation
   - (d) The researcher

2. What does a meta-analysis do?
   - (a) It reexamines the results of a disputed study.
   - (b) It looks for deeper, hidden meanings.
   - (c) It considers the possible conclusions from data not yet collected.
   - (d) It combines the results from many studies.

3. Are Nostradamus's predictions falsifiable? Why or why not?
   - (a) Yes, they are falsifiable, because many have not come true.
   - (b) Yes, they are falsifiable, because they have not been studied scientifically.
   - (c) Yes, they are falsifiable, because some of the predictions contradict one another.
   - (d) No, they are not falsifiable, because they make no unambiguous predictions.

4. A search for parsimony is a search for what?
   - (a) Falsifiability
   - (b) Simplicity
   - (c) Replicability
   - (d) Deep meaning

5. The claims for ESP lack two essential aspects. What are they?
   - (a) Hypotheses and data
   - (b) Egocentrism and perspicacity
   - (c) Replicability and parsimony
   - (d) Structuralism and functionalism

Answer: 1b, 2d, 3d, 4b, 5c.

Thought Question

For the statement, "Ours is just one of an infinite number of universes," who has the burden of proof—those who support the statement or those who deny it? How should we handle a statement when it may be impossible to get firm evidence either for it or against it?

module 2.2

Conducting Psychological Research

After studying this module, you should be able to:

1. Give examples of operational definitions.

2. Distinguish between convenience samples, representative samples, random samples, and cross-cultural samples.

3. Explain why experiments can lead to cause-and-effect conclusions, whereas correlational studies do not.

4. Cite pitfalls that might compromise the effectiveness of a survey or an experiment.

5. Describe how researchers use descriptive and inferential statistics to evaluate the results of a study.

6. Discuss reasons why a study's results might not be replicable.

7. Discuss how psychological researchers deal with ethical issues.

Psychology, like any other field, makes progress only when its practitioners distinguish between strong evidence and weak evidence. The goal of this module is not necessarily to prepare you to conduct your own psychological research, but to help you interpret research results intelligently. When you hear about a new study, you should be able to ask pertinent questions to decide how good the evidence is, what conclusion follows, and how confidently you should accept that conclusion.

General Research Principles

Research falls into two major categories, basic and applied. **Basic research** seeks theoretical knowledge, such as understanding the processes of learning and memory. **Applied research** deals with practical problems, such as how to help children with learning disabilities or how to improve study habits. The two kinds of research are mutually supportive. Understanding the basic processes helps applied researchers develop effective interventions. Those working toward practical solutions sometimes discover principles that are theoretically important.

Psychological researchers use scientific methods, but they face problems that chemists and physicists do not. One problem is sampling. A psychologist who studies a group of people has to worry about whether they might be unusual in some way. A chemist studying, say, methane molecules doesn't have that worry. One sample of methane molecules is the same as another. Another problem is that people who know they are in a research study behave self-consciously, because they know someone is watching. Chemists don't have that worry about a jar of chemicals. In this module, we explore some of the special ways that psychologists adapt scientific principles.

concept check

4. Is a study of cultural differences in social behavior an example of basic or applied research?

Answer

4. It is basic research, an attempt to understand something. However, it could lead to practical applications.

Operational Definitions

Suppose a physicist asks you to measure the effect of temperature on the length of an iron bar. You reply, "What do we *really mean* by temperature?" The physicist sighs, "Don't worry about it. Here is a thermometer and a ruler. Go measure them."

Psychological researchers use the same strategy. If we want to measure the effect of anger on behavior, we could debate forever about what anger really is, or we could choose a way to measure it. We might ask people to tell us how angry they are, or we might count frowns per minute or swear words per minute, or we might find some other way to measure anger. In doing so, we are using an **operational definition**, *a definition that specifies the operations (or procedures) used to produce or measure something, if possible giving it a numerical value.* You might object that "frowns per minute" is not what anger really is. Of course not, but the reading on a thermometer is also not what temperature really is. An operational definition just says how to measure something. It lets us get on with research.

Suppose we want to investigate friendliness. We would need an operational definition of friendliness. We might define your friendliness as the number of people you smile at during an hour or the number of people you list as close friends. We might operationally define *love* as "how long you remain with someone who asks you to stay nearby."

concept check

5. **Which of the following is an operational definition of forgetting?**

a. The process whereby a memory trace decays in the brain

b. An inability to remember something that you once knew

c. What happens when you don't study hard enough

d. The difference between scores on memory tests at two times

6. **In a study of nonhuman animals, what would you propose as an operational definition of "good mothering"?**

Answers

5. (d) The difference between two scores is an operational definition, because it specifies a way to measure.
6. An effective operational definition would be the number of offspring that survive to maturity. Other definitions are possible if they include a method of measurement.